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23   **SYSTEM, METHOD, AND COMPUTER PROGRAM FOR CREATING AND VALUING**
24   **FINANCIAL INSTURMENTS LINKED TO REAL ESTATE INDICES**

28   **TECHNICAL FIELD**

30   The present invention relates generally to financial trading systems and more particularly to the

31   creation, identification, processing, trading, quotation, and valuation of real estate index linked

32   financial instruments such as derivatives and the like.

35   **BACKGROUND OF THE INVENTION**

36   Related Art

38   In today's financial markets, the use of financial instruments known as "derivatives" have

39   exponentially grown and is now commonplace. A derivative is an investment vehicle whose

40   value is based on the value of another security or underlying asset. That is, a derivative is

1

1   essentially a financial instrument that is derived from the future movement of something that

2   cannot be predicted with certainty. By the late 1990s the Office of the Comptroller of the

3   Currency estimates that commercial banks in the United States alone held over twenty trillion

4   dollars worth of derivative-based assets. Common examples of derivatives include futures

5   contracts, forward contracts, options, and swaps, all of which are briefly explained below.

6   Derivatives are described in detail in a variety of publicly available documents, such as Morris,

7   Kenneth, The Wall Street Journal's Guide To Understanding Money & Investing, Lightbulb

8   Press and Dow Jones & Co. Inc., ISBN: 0684869020, which is incorporated herein by reference

9   in its entirety.

10

11   Options contracts are agreements that may be exchange-traded among two parties. Options

12   represent the right to buy or sell a specified amount of an underlying security (e.g. a stock, bond,

13   index, futures contract, etc.) at a specified price within a specified period of time. The parties of

14   options contracts are buyers / purchasers / holders who acquire "rights," and writers / sellers who

15   assume "obligations." Further, a "call" option contract is one giving the owner the right to buy at

16   a specified price within a specified period of time, whereas a "put" option contract is one giving

17   the owner the right to sell at a specified price within a specified period of time. There is

18   typically an up-front, non-refundable premium that the buyer pays the seller to obtain the option

19   rights. Note that for every option buyer there is an option seller. In other words, for every call

20   buyer there is a call seller; for every put buyer, a put seller.

21

22   Forward and futures contracts are standardized, transferable agreements, which may be

23   exchange-traded, to buy or sell a commodity (e.g. a particular crop, livestock, oil, gas, etc.).

24   These contracts typically involve an agreed-upon place and time in the future between two

25   parties, and lock in a price per unit at which delivery or settlement takes place.

26

27   Futures markets have been described as continuous auction markets and as clearing houses for

28   the latest information about supply and demand. They are the meeting places of buyers and

29   sellers of an ever-expanding list of commodities that today includes agricultural products, metals,

30   . petroleum, financial instruments, foreign currencies and stock indexes. As new supply and

31   demand developments occur and as new and more current information becomes available, these

2

1 judgments are reassessed and the price of a particular futures contract may be bid upward or

2 downward. The process of reassessment--of price discovery--is continuous. There are two types

3 of futures contracts, those that provide for physical delivery of a particular commodity or item

4 and those which call for a cash settlement. The month during which delivery or settlement is to

5 occur is specified. Thus, a July futures contract is one providing for delivery or settlement in

6 July. In contrast, cash settlement futures contracts are precisely that, contracts which are settled

7 in cash rather than by delivery at the time the contract expires. Stock index futures contracts, for

8 example, are settled in cash on the basis of the index number at the close of the final day of

9 trading. There is no provision for delivery of the shares of stock that make up the various

10 indexes. Trading has also been initiated in options on futures contracts, enabling option buyers

11 to participate in futures markets with known risks.

12

13 Swaps allow entities to exchange either variable cash flows for fixed payments, fixed cash flows

14 for fixed payments, or variable cash flows for variable payments. They are similar to options but

15 no premium (i.e., up-front money) is paid to obtain the rights. It is essentially an outright trade

16 based on the expected movement of the price of the derivative's underlying commodity.

17 Options on futures contracts have added a new dimension to futures trading. Present-day options

18 trading on the floor of an exchange began in April 1973 when the Chicago Board of Trade

19 created the Chicago Board Options Exchange (CBOE) for the sole purpose of trading options on

20 a limited number of New York Stock Exchange-listed equities. Options on futures contracts

21 were introduced at the CBOT in October 1982 when the exchange began trading Options on U.S.

22 Treasury Bond futures. An option, when purchased, gives the buyer the right (but not the

23 obligation) to buy or sell a specific amount of a specific commodity at a specific price within a

24 specific period of time. By comparison, a futures contract requires a buyer or seller to perform

25 under the terms of the contract if an open position is not offset before expiration. Put and call

26 options on futures contracts make it possible to speculate on increasing or decreasing futures

27 prices with a known and limited risk. The most that the buyer of an option can lose is the cost of

28 purchasing the option (known as the option "premium") plus transaction costs.

29

30 The buyer of a call option acquires the right but not the obligation to purchase ("go long") a

31 particular futures contract at a specified price at any time during the life of the option. Each

1   option specifies the futures contract which may be purchased (known as the "underlying" futures

2   contract) and the price at which it can be purchased (known as the "exercise" or "strike" price).

3   The most that an option buyer can lose is the option premium plus transaction costs. This will be

4   the case if an option held until expiration is not worthwhile to exercise.

5

6   Whereas a call option conveys the right to purchase ("go long") a particular futures contract at a

7   specified price, a put option conveys the right to sell ("go short") a particular futures contract at a

8   specified price. Put options can be purchased to profit from an anticipated price decrease. As in

9   the case of call options, the most that a put option buyer can lose, if he is wrong about the

10   direction or timing of the price change, is the option premium plus transaction costs.

11

12   How Option Premiums are Determined

13

14   Option premiums are determined the same way futures prices are determined, through active

15   competition between buyers and sellers. Three major variables influence the premium for a given

16   option:

17

18   • The option's exercise price, or more specifically, the relationship between the exercise

19   price and the current price of the underlying futures contract, index, etc. All else being

20   equal, an option that already has intrinsic value because it is already worthwhile to

21   exercise (known as an "in-the-money" option, where the underlying value is greater than

22   the strike value for a call, or where the underlying value is less than the strike value for a

23   put) commands a higher premium than an option that is not yet worthwhile to exercise

24   (an "out-of-the-money" option, where the underlying value is less than the strike value

25   for a call, or where the underlying value is greater than the strike value for a put). The

26   more an option is in-the-money, the more it is worth

27   • The length of time remaining until expiration. All else being equal, an option with a long

28   period of time remaining until expiration commands a higher premium than an option

29   with a short period of time remaining until expiration because it has more time in which

30   to become profitable. Said another way, an option is an eroding asset. Its time value

31   declines as it approaches expiration.

1   • The volatility of the underlying futures contract. All else being equal, the greater the

2   volatility the higher the option premium. In a volatile market, the option stands a greater

3   chance of becoming profitable to exercise; thus, buyers pay more while writers demand

4   higher premiums.

5

6   The price (value) of an option premium on a futures contract is determined competitively by

7   open outcry auction on a trading floor (e.g. CBOT, NYME). The premium is affected by the

8   influx of buy and sell orders reaching the exchange floor. An option buyer pays the premium in

9   cash to the option seller. This cash payment is credited to the seller's account. Such price

10 determination may just as easily occur on an electronic platform which processes incoming buy

11 and sell orders, and it is the intention of many exchanges to migrate to this newer method of

12 conducting trading operations.

13

14 Price Movements

15

16 Once a closing bell signals the end of a day's trading, the exchange's clearing organization

17 matches each purchase made that day with its corresponding sale and tallies each member firm's

18 gains or losses based on that day's price changes--a massive undertaking considering that nearly

19 two-thirds of a million futures contracts are bought and sold on an average day. Each firm, in

20 turn, calculates the gains and losses for each of its customers having futures contracts.

21

22 Gains and losses on futures contracts are not only calculated on a daily basis, they are credited

23 and deducted on a daily basis. Thus, if a speculator were to have, say, a $300 profit as a result of

24 the day's price changes, that amount would be immediately credited to his brokerage account

25 and, unless required for other purposes, could be withdrawn. On the other hand, if the day's

26 price changes had resulted in a $300 loss, his account would be immediately debited for that

27 amount. This process is known as a daily cash settlement and is an important feature of futures

28 trading. Because of margin requirements, it is the reason a party which incurs a loss on a futures

29 position may be called on to deposit additional funds to its account.

30

1   The leverage of futures trading stems from the fact that only a relatively small amount of money

2   (known as initial margin) is required to buy or sell a futures contract. On a particular day, a

3   margin deposit of only $1,000 might enable an investor to buy or sell a futures contract covering

4   $25,000 worth of soybeans. Or for $10,000, the investor might be able to purchase a futures

5   contract covering common stocks worth $260,000. The smaller the margin in relation to the

6   value of the futures contract, the greater the leverage. Leverage can produce either large profits

7   in relation to initial margin, or large losses, depending on which way the price on the underlying

8   futures contract changes. In this respect, leverage is a two-edged sword. For example, assume

9   that in anticipation of rising stock prices an investor buys one June S&P 500 stock index futures

10 contract at a time when the June index is trading at 1000 (assuming an initial margin requirement

11 of $10,000). Since the value of the futures contract is $250 times the index, each 1 point change

12 in the index represents a $250 gain or loss. Thus, an increase in the index from 1000 to 1040

13 would double the $10,000 margin deposit and a decrease from 1000 to 960 would wipe it out. In

14 this example, that's a 100% gain or loss as the result of only a 4% change in the stock index

15 Leverage will have a similar impact on real estate index linked futures contracts.

16

17 Real estate index linked futures contacts will have both initial margin and maintenance margin.

18 Initial margin (sometimes called original margin) is the sum of money that the customer must

19 deposit with the brokerage firm for each futures contract to be bought or sold. Profits will accrue

20 on open positions and losses will be deducted from the balance in the margin account. If and

21 when the funds remaining available in the margin account are reduced by losses to below a

22 certain level--known as the maintenance margin requirement—an additional deposit of funds

23 will be required to bring the account back to the level of the initial margin. Such requests for

24 additional margin are known as margin calls.

25

26 Derivatives are typically used by institutional investors to increase overall portfolio return or to

27 manage portfolio risks. Derivatives are also frequently used by banks, companies, organizations,

28 and the like to protect against market risks in general. For example, utility companies may be

29 interested in protecting against meeting heating or cooling demands when unexpected weather

30 occurs, and banks may be interested in protecting against the risk of loan defaults. Derivatives

31 help in managing risks by allowing such banks, companies, organizations, and the like to divide

1   their risk into several pieces that may be passed off to other entities that are willing to shoulder

2   the risk for an up-front fee or future payment stream.

3

4   Derivatives, being a type of financial instrument, may be traded among investors as are stocks,

5   bonds, and the like. Thus, in order to trade derivatives, there must be a mechanism to price them

6   so that traders may exchange them in an open market.

7

8   The relationship between the value of a derivative and the underlying asset are not linear and can

9   be very complex. Economists have developed pricing models to perform valuation of certain

10   types of derivatives. As is well known in the relevant art(s), the Black-Scholes option pricing

11   model is the most influential and extensively used pricing model. The Black-Scholes model is

12   based on stochastic calculus and is described in detail in a variety of publicly available

13   documents, such as Chriss, Neil A., The Black-Scholes and Beyond Interactive Toolkit: A Step-

14   by-Step Guide to In-depth Option Pricing Models, McGraw-Hill, 1997, ISBN: 078631026X

15   (USA), which is incorporated herein by reference in its entirety.

16

17   Whether using the Black-Scholes or any other pricing model, each has inherent flaws and thus

18   poses risks. It has been estimated that some 40% of losses in dealing with derivatives can be

19   traced to problems related to pricing models. Risks in relying on any model include errors in the

20   model's underlying assumptions, errors in calculation when using the model, and failure to

21   account for variables (i.e., occurrences) that may affect the underlying assets.

22   Real estate indices, and more specifically future expected movement in such indices, have not

23   yet been an area of application for pricing models. The few models that have considered real

24   estate prices usually have only considered past (i.e., historical) real estate price or index data.

25   That is, most models assume, for example, that real estate prices are cyclical in nature.

26   Historical analysis has shown, however, that this assumption does not always hold true. Thus,

27   regardless of the index or instrument, risk management trading techniques or vehicles, traders

28   essentially have been operating in the "blind" without knowledge of real estate predicted future

29   index movements.

30

31   SUMMARY OF THE INVENTION

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1

2   The present invention is a system, method, and computer program product for the creation,

3   identification, processing, trading, quotation, and valuation of real estate index linked financial

4   instruments and / or financial instruments that are impacted in some manner by real estate

5   indices. The method preferably involves specifying a start date and maturity date for the

6   financial instrument, and selecting at least one geographic region to be covered by the financial

7   instrument, and at least one currency denomination in which to represent the financial

8   instrument. Then, at least one real estate index that the financial instrument will derive its value

9   from or is related to (or impacted by) is selected. The index to be used could be from (but is not

10   limited to) one of the following index compilations cited here as examples, and which are

11   incorporated herein by reference in their entirety:

12

13   • Freddie Mac Conventional Mortgage Home Price Index: MSA (Metropolitan Statistical
14   Area) Series

15

16   • Office of Management and Budget Metropolitan and Micropolitan Statistical Areas and
17   Principal Cities (Source: Population Division, U.S. Census Bureau)

18

19   • Japan Real Estate Institute (JREI) Indices

20

21   • Office of Federal Housing Enterprise Oversight (OFHEO) House Price Index and other
22   reports

23

24   • National Property Index (NPI) published by National Council for Real Estate Investment
25   Fiduciaries (NCRIEF)

26

27   • Netherlands: ROZ / IPD property index

28

29   • UK IPD

30

31   • F&T Price Indices of Real Estate in Some Large and Medium Cities in China in 1Q/2003

1

2 • F&T Movement Indices for Chinese cities, including but not limited to: Shenzhen,
3   Chendu, Chongqin, Tianjin, Beijing and Shanghai.

4

5 • National Association of Realtors' Real Estate Outlook (published monthly)

6

7 • Department of Housing and Urban Development: U.S. Housing Market Conditions

8

9 • Urban Redevelopment Authority of Singapore: Price & Rental Indices

10

11 Other sources for real estate index information include, but are not limited to: European

12 Mortgage Federation, International Union for Housing Finance, Bulwien, ESRI, Ministerio de

13 Fomento, Nationwide Building Society, Nomisma, Stadium, BIS, Credit Suisse First Boston,

14 HSBC, UBS, ABS, Jones Lang Lasalle, Investment Property Databank, and Deutsche Bank.

15

16 Indices that may be selected may even apply to a subset of a regional market. For example, F&T

17 supplies the following index publications upon which real estate index linked financial

18 instruments may be created for the purposes of speculation upon a particular market segment

19 within a geography:

20

21 • F&T Supply and Demand Area of Newly Marketed Non-residential Projects in Jan.-Mar.
22   2003 in Fuzhou

23

24 • F&T Comparison of Quantitative Indices of Luxurious Houses in Shenzhen and Hong
25   Kong

26

27 • F&T Major Indices of Office Buildings in Beijing Financial Street in 2002-Mar. 2003

28

29 Finally, property indices published by private firms may be considered as a basis for real estate

30 index linked financial instruments. An example would be the CB Richard Ellis series, such as

31 CB Richard Ellis Global Market Rents report.

1

2   Additionally, International Commercial Property Associates has maintained a database of

3   commercial rents and yields for a number of countries around the world. The rent data is

4   gathered by Hillier-Parker in the U.K. and affiliates in Southeast Asia and Australia and

5   Landauer in the U.S. Other real estate research firms report information to ICPA for rents in

6   Europe, Canada and Scandinavia. These data, despite certain limitations, provide a fascinating

7   glimpse of the world real estate crash over the late 1980s and late 1990s.

8

9   Because of the particular characteristics of real estate, representing real estate markets through a

10   reliable time-series is a complex task. Consequently, reliable real estate indices with a

11   sufficiently long history in major international real estate markets are only scarcely available.

12   Most of the research that has been done on real estate returns was done for the U.K. and U.S.,

13   where eligible indices exist. On the other hand, in other important real estate markets, such as

14   Germany, either little or no research has been performed.

15

16   The advantage of the present invention is that it can easily be implemented from existing

17   financial infrastructure. The present invention makes use of real estate indices, financial

18   instruments such as options, and pricing models to create a new class of financial instruments

19   that are priced based on linkages to underlying real estate index data. Much as options exist on

20   the Standard & Poor's 500 index, real estate index linked financial instruments allow buyers and

21   sellers to speculate upon the movement of broad swaths of the global real estate market. Real

22   estate index linked financial instruments call for cash settlement rather than delivery of the

23   underlying physical stock, commodity, or other asset type upon which derivative financial

24   instruments may be based. Delivery-type futures contracts, for example, stipulate the

25   specifications of the commodity to be delivered (such as 5,000 bushels of grain, 40,000 pounds

26   of livestock, or 100 troy ounces of gold). Also, foreign currency futures provide for delivery of a

27   specified number of euros, yen, pounds or pesos. U.S. Treasury obligation futures are in terms

28   of instruments having a stated face value (such as $100,000 or $1 million) at maturity. In

29   contrast, for example, derivative financial instruments which call for cash settlement rather than

30   delivery are based on a given index number times a specified dollar multiple. This is the case,

31   for example, with stock index futures – and is also be the case with the present invention since

1 real estate index linked financial instruments are linked by their very definition to underlying

2 indices. One possible mechanism for facilitating this form of settlement would be cashless

3 exercise. Cashless exercise is a transaction used when exercising certain types of options.

4 Essentially, the investor borrows enough money from his / her broker to exercise the options.

5 The investor then simultaneously sells enough shares to pay for the purchase, taxes, and broker

6 commissions. The investor is technically buying on margin. The brokerage lets the investor buy

7 on margin in this case because the brokerage knows there will be a quick repayment. The

8 advantage of this technique is that the investor does not need the cash on hand.

9

10 The present invention includes a systemic component that processes real estate index information

11 according to inputs. In the preferred embodiment of the present invention, a financial database

12 may be accessed so that an interest rate or rates can be specified for use in pricing a financial

13 instrument based upon an underlying real estate index. A real estate index history database and a

14 real estate predicted future index database are then accessed to obtain historic real estate index

15 information and the real estate predicted future index information for the geographic location

16 during the period between the start date and the maturity date. A pricing model can then be

17 applied to obtain a value for the real estate index linked financial instrument using the historical

18 real estate index information, the real estate predicted future index information, and the risk-free

19 rate.

20

21 The system for the valuation of a real estate index linked financial instrument of the present

22 invention includes a real estate index history database that stores historical real estate index

23 information for one or more indices, and / or a real estate predicted future index database that

24 stores real estate predicted future index information for the one or more indices. The system

25 may also include a financial database that stores information in order to calculate a risk-free rate.

26 In order to access the databases and perform valuation of financial instruments, a trading server

27 is included within the system. The trading server provides the central processing of the system

28 by applying a pricing model, and is responsive to a plurality of internal and external workstations

29 that allow users, via a graphical user interface, to access the trading system.

30

31 One advantage of the present invention is that the futures, options, swaps, and other derivative

1 financial instruments which comprise the present invention can allow investors to trade on

2 information related to how real estate prices will trend in geographic areas such as localities,

3 cities, regions, states, nations, or multinational / international areas. In the preferred embodiment

4 of the present invention, real estate index linked financial instruments will call for a cash

5 settlement rather than physical delivery, as physical delivery is not possible in the case of

6 financial instruments that are linked to underlying indices instead of physical commodities (such

7 as oil or stock). As previously mentioned, one possible mechanism for facilitating this form of

8 settlement would be cashless exercise. It is also a preferred embodiment of the present invention

9 that buyers and sellers of real estate index linked financial instruments may place their orders

10 through a brokerage agent or trader to facilitate execution on a physical or electronic exchange.

11

12 Another advantage of the present invention is that information and data sets can be provided that

13 enable traders to identify and capitalize on real estate index-driven market fluctuations.

14

15 Further features and advantages of the invention as well as the structure and operation of various

16 embodiments of the present invention are described in detail below with reference to the

17 accompanying drawings.

18

19 **BRIEF DESCRIPTION OF THE DRAWINGS**

20 The features and advantages of the present invention will become more apparent from the

21 detailed description set forth below when taken in conjunction with the drawings in which like

22 reference numbers indicate identical or functionally similar elements. Additionally, the left-most

23 digit of a reference number identifies the drawing in which the reference number first appears.

24

25 **FIGURE 1**   is a block diagram representing the system architecture of an embodiment of the

26 present invention;

27

28 **FIGURE 2**   depicts a preferred real estate index history database which may be used by the

29 present invention;

30

31 **FIGURE 3**   depicts a preferred real estate predicted future index database which may be used

1   by the present invention;

2

3   **FIGURE 4**   is a flowchart representing the preferred operation of the present invention;

4

5   **FIGURE 5**   is an exemplary graphical user interface screen for the trading system of the

6   present invention; and

7

8   **FIGURE 6**   is a block diagram of an exemplary computer system useful for implementing the

9   present invention.

10

11   **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

12

13   A.   Overview of Real Estate Index Linked Financial Instruments

14   1.   How Real Estate Index Linked Financial Instruments Are Created And Used

15

16   Recently, with speculation on potentially overpriced real estate in America, Britain and

17   Australia, the need for a new type of financial instrument has become evident—a real estate

18   index-linked financial instrument. The present invention allows the creation, identification,

19   processing, trading, quotation, and valuation of a new type of financial instrument which is a real

20   estate index linked financial instrument. A real estate index linked financial instrument is a

21   contract whose value is based on the fluctuations in indices for real estate prices on the local,

22   city, regional, state, national, or multinational / international level. Real estate index linked

23   financial instruments may be utilized, by way of example but not limited to, REITs (real estate

24   investment trusts) which may want to buy put options based on a real estate index in order to

25   manage the risk of a collapse in real estate prices in a city or state where the REIT owns real

26   estate. Settlement of such contracts may involve initial margin / good faith deposits to allow

27   buyers to employ leverage at the time of purchase and thus put down less cash than the face

28   value of the contract at the time of purchase. The settlement transactions could take place based

29   on each day's closing price of the instrument in question.

1   A real estate index linked futures contract (a subset of real estate index linked financial

2   instruments) is designed to trade either on an exchange or system (either open-outcry or

3   electronic), an ECN (electronic commerce system), an over-the-counter system (OTC). The

4   terms and definition of this futures contract are similar to that of existing futures contracts, but

5   are not necessarily limited in scope to those existing instruments. Forward and futures contracts

6   are standardized, transferable agreements, which may be exchange-traded, to buy or sell a

7   commodity (e.g. a particular crop, livestock, oil, gas, etc.). These contracts typically involve an

8   agreed-upon place and time in the future between two parties.

9

10   Real estate index linked options contracts are also a subset of real estate index linked financial

11   instruments. Typically, options contracts are agreements that may be exchange-traded among

12   two parties. Options represent the right to buy or sell a specified amount of an underlying

13   security (e.g. a stock, bond, futures contract, etc.) at a specified price within a specified time.

14   The parties of options contracts are purchasers who acquire "rights," and sellers who assume

15   "obligations." Further, a "call" option contract is one giving the owner the right to buy, whereas

16   a "put" option contract is one giving the owner the right to sell the underlying security. There is

17   typically an up-front, non-refundable premium that the buyer pays the seller to obtain the option

18   rights. With regards to a real estate index linked options contract, there is no underlying

19   security, but rather an underlying index value tied to real estate price performance in a particular

20   municipality, micropolitan area, metropolitan area, state or province, nation, or multi-nation

21   region.

22   The pricing of an option of an asset is a fundamental problem of significant practical importance

23   in today's financial markets. In 1973, a mathematician, Fischer Black, and an economist, Myron

24   Scholes, devised one of the first mathematically accepted approaches for pricing what is known

25   as a "European" option, which are options that can only be exercised at its expiration date. What

26   has become known as the Black-Scholes option formula was described first in "The pricing of

27   options and corporate liabilities," Journal of Political Economy 81 (1973), which is incorporated

28   herein by reference in its entirety. The Black-Scholes option formula is presently of widespread

29   use in financial markets all over the world. The price of such an option can be found by solving

30   the Black-Scholes equation with the initial condition at expiration (i.e., the payoff of the option).

31   The Black-Scholes equation is a reverse diffusion equation with parameters determined by the

1   statistical characteristics of involved stocks and currencies such as risk free interest rate, holding

2   cost or expected dividends, and volatility.

3

4   As an example, the Black-Scholes formula for the theoretical price of a vanilla European call

5   option is:

6

7    $C = S*N(d_1) - Ke^{-(rt)} *N(d_2)$ (1)

8

9   where the notation is fairly standard, as described by P. Wilmott, J. N. Dewynne and S.

10   Howison, "Option Pricing: Mathematical Models and Computation", Oxford Financial Press,

11   Oxford (1993).

12

13   However, in the case of American options, the above formula (1) and its analogs are no longer

14   valid. In fact, as shown in P. Jaillet, D. Lamberton, and B. Lapeyre, "Variational inequalities and

15   the pricing of American options," Acta Applicandae Mathematicae 21 (1990) 263-289, a

16   rigorous mathematical model for pricing an American option is an infinite-dimensional free

17   boundary problem, which is incorporated herein by reference in its entirety. As such, there is in

18   general no explicit formula or finite procedure for computing the exact price of an American

19   option. As a result, various mathematical models have been devised in an attempt to

20   approximate the price of such options.

21

22   The option prices computed from a mathematical model are of a theoretical nature. In

23   computing these prices, various inputs are fed into the model and an algorithm produces an

24   answer. In practice, the computed prices may not be consistent with the observed market prices,

25   e.g., the prices on the trading floor. Ideally, these two sets of prices should coincide. However,

26   such a result is difficult, if not impossible, using known models. Two principal reasons for this

27   are: (i) the assumptions that lead to the construction of the mathematical model may not be

28   realistic; and (ii) the inputs to the model are not correct. In particular, using an incorrect

29   volatility parameter in the forward option pricing model means that the computed option price is

30   bound to deviate, often substantially, from the option price observed on the trading exchange,

31   either physical or electronic.

1

2 Previous approaches for dealing with this difficult problem of unknown volatility are numerous

3 and include: (i) statistical estimation methods based on historical data (such as J. Hull, Options,

4 Futures, and Other Derivative Securities, Second Edition, Prentice Hall, New Jersey (1989),

5 Section 10.4 and R. Gibson, Option Valuation: Analyzing and Pricing Standardized Option

6 Contracts, McGraw-Hill, New York (1991), Section 1; (ii) mathematical models of stochastic

7 volatilities such as those in J. Hull and A. White, "The pricing of options on assets with

8 stochastic volatilities," The Journal of Finance 42 (1987) 281-300; H. Johnson and D. Shanno,

9 "Option pricing when the variance is changing," Journal of Financial and Quantitative Analysis

10 22 (1987) 143-151; and (iii) implied volatilities based on observed option prices (suggested

11 originally by H. A. Latant and R. J. Rendleman, "Standard deviations of stock price ratios

12 implied in option prices," The Journal of Finance 31 (1976) 369-381 and empirically tested by S.

13 Beckers, "Standard deviation implied in option prices as predictors of future stock price

14 volatility" Journal of Banking and Finance 5 (1981) 363-381). All of these works are

15 incorporated herein by reference in their entirety.

16

17 Options on Real Estate Index Linked Futures Contracts

18

19 These are options that will have their value determined by the dependence on an underlying real

20 estate index linked futures contract.

21

22 *Real Estate Index Linked Call Option on Futures Contract*: This call option on a futures contract

23 is an option where the purchaser has the right, but not the obligation, to buy the underlying

24 security from the writer / seller of the option during a defined period of time at a fixed price

25 wherein the underlying security is a real estate index linked futures contract. Settlement could

26 require the exchange of the entire transaction value between the buyer and writer / seller, or

27 exchange of the prevailing market price for the underlying security less the strike "price" or

28 index value of the option.

29

30 *Real Estate Index Linked Put Option on Futures Contract*: This put option on a futures contract

31 is an option where the purchaser has the right, but not the obligation, to sell the underlying

1   security to the writer / seller of the option during a defined period of time at a fixed price

2   wherein the underlying security is a real estate index linked futures contract. Settlement could

3   require the exchange of the entire transaction value between the buyer and writer / seller, or

4   exchange of the strike price or index value of the option less the prevailing market price for the

5   underlying security.

6

7   Real Estate Index Linked Options

8

9   *Real Estate Index Linked American Option*: An option that can be exercised anytime during its

10   life. The majority of exchange-traded options are American style. The name has nothing to do

11   with geographic location.

12

13   *Real Estate Index Linked Asian Option*: An option whose payoff depends on the average price of

14   the underlying asset over a certain period of time. These types of option contracts are attractive

15   because they tend to cost less than regular American options. Also known as an 'average option'.

16

17   *Real Estate Index Linked Asset-or-Nothing Call Option*: An option payoff that is equal to the

18   asset's price if the asset is above the strike price, otherwise the payoff is zero.

19

20   *Real Estate Index Linked Asset-or-Nothing Put Option*: An option payoff that is equal to the

21   asset's price if the asset is below the strike price, otherwise the payoff is zero.

22

23   *Real Estate Index Linked Average Price Call*: A type of option where the payoff is either zero or

24   the amount by which the average real estate index linked value exceeds the strike.

25

26   *Real Estate Index Linked Average Price Put*: A type of option where the payoff is either zero or

27   the amount by which the strike price exceeds the average real estate index linked value.

28

29   *Real Estate Index Linked Balloon Option*: An option for which the notional payments increase

30   significantly after a set threshold is broken. Commonly used in foreign exchange markets, these

31   options provide for greater leverage to the holder. The main idea behind the balloon option is

1 that after the threshold is exceeded, the regular payout is increased. For example, assume that

2 the threshold is $100. After the underlying exceeds this amount, rather than paying the regular

3 dollar-for-dollar amount, the option payment would balloon to two dollars for every one-dollar

4 change against the strike price.

5

6 *Real Estate Index Linked Barrier Option*: A type of option where the payoff depends on whether

7 or not the underlying asset has reached or exceeded a predetermined price. A barrier option is a

8 type of exotic option. Barrier options can be either knock-ins or knock-outs.

9

10 *Real Estate Index Linked Basket Option*: A type of option where the underlying value is a basket

11 of real estate indices. This allows the buyer / holder to speculate upon a group of real estate

12 indices with various weightings in the basket. For example, a buyer could purchase a real estate

13 index linked basket option from a seller that is weighted accordingly: 30% to a real estate index

14 derived from real estate prices in New York City, 30% to a real estate index derived from real

15 estate prices in London, 20% to a real estate index derived from real estate prices across Japan as

16 a whole, 10% to a real estate index derived from real estate prices across both the United

17 Kingdom and Ireland, 5% to a real estate index derived from real estate prices across the state of

18 California, and 5% to a real estate index derived from real estate prices in Toledo, Ohio. As will

19 be apparent to those skilled in the art, real estate index linked basket options may be constructed

20 across millions of permutations involving the selection of:

21

22 1.) a different index, indices or types of indices

23 2.) different weightings per index, indices or type of index

24 3.) different pay-in and / or payout currencies per weighting per index, indices, or type of index

25 4.) different triggers that may affect weightings at points in time for each index, indices, or types

26 of indices

27 5.) differing option specifications and / or types per index, indices, or types of indices. For

28 example, a real estate index linked basket option could be created with a call-type option

29 (American exercise) on a 50% weighting in a New York City real estate index, a put-type option

30 (Bermuda exercise) on a 30% weighting in a State of New Jersey real estate index, and a

31 chooser-type option on a 20% weighting in a United States real estate index.

1   6.) different swaps and / or swap "legs" linked to each index, indices or types of indices

2   comprising a real estate index linked basket option

3   7.) different swaptions linked to each index, indices, or types of indices comprising a real estate

4   index linked basket option

5   8.) different commodities linked to each index, indices, or types of indices comprising a real

6   estate index linked basket option

7   9.) different forwards linked to each index, indices, or types of indices comprising a real estate

8   index linked basket option

9   10.) different futures linked to each index, indices, or types of indices comprising a real estate

10   index linked basket option

11   11.) different caps linked to each index, indices, or types of indices comprising a real estate

12   index linked basket option

13   12.) different floors linked to each index, indices, or types of indices comprising a real estate

14   index linked basket option

15   13.) different collars linked to each index, indices, or types of indices comprising a real estate

16   index linked basket option

17   14.) different corridors linked to each index, indices, or types of indices comprising a real estate

18   index linked basket option

19   15.) different real estate index linked notes linked to each index, indices, or types of indices

20   comprising a real estate index linked basket option

21   16.) different financial guarantees linked to each index, indices, or types of indices comprising a

22   real estate index linked basket option

23   17.) different fixed-income instruments linked to each index, indices, or types of indices

24   comprising a real estate index linked basket option

25   18.) different fixed-income indices linked to each index, indices, or types of indices comprising a

26   real estate index linked basket option

27   19.) different equities linked to each index, indices, or types of indices comprising a real estate

28   index linked basket option

29   20.) different equity indices linked to each index, indices, or types of indices comprising a real

30   estate index linked basket option

1   21.) different commodity indices linked to each index, indices, or types of indices comprising a

2   real estate index linked basket option

3   22.) different futures indices linked to each index, indices, or types of indices comprising a real

4   estate index linked basket option

5   23.) different forwards indices linked to each index, indices, or types of indices comprising a real

6   estate index linked basket option

7   24.) different swap indices linked to each index, indices, or types of indices comprising a real

8   estate index linked basket option

9   25.) different option indices linked to each index, indices, or types of indices comprising a real

10   estate index linked basket option

11

12   As a result of the component of the present invention known as real estate index linked basket

13   options, investors may now construct investment positions that can benefit almost any portfolio

14   strategy involving a geographic real estate component. As will be apparent to those skilled in the

15   relevant arts, the above example and detailed list of permutations should in no way be construed

16   to limit the spirit and scope of the present invention, which allows a vast array of arbitrage

17   possibilities for investors and speculators to explore with the creation of real estate index linked

18   financial instruments.

19

20   *Real Estate Index Linked Bermuda Option*: A type of option that can only be exercised on

21   predetermined dates, usually every month. "Bermudas" are a combination of American and

22   European style options.

23

24   *Real Estate Index Linked Call Option*: A call option where the purchaser has the right, but not

25   the obligation, to buy a value as a strike price in the underlying index from the writer / seller of

26   the contract during a defined period of time at a fixed price, wherein the underlying index is a

27   real estate index with numerical values published at regular time intervals. The buyer profits on

28   a call when the underlying index increases in value above the purchased value or strike price of

29   the option. A premium is paid by the investor / buyer / holder of the option to the writer / seller

30   of the option for this right. Settlement could require the exchange of the entire transaction value

31   between the buyer and writer / seller, or the exchange of the prevailing market index value of the

1   underlying real estate index less the strike price or index value of the contract, times a cash

2   multiple.

3

4   *Real Estate Index Linked Capped Option*: An option with a pre-established profit cap. A capped

5   option is automatically exercised when the underlying security closes at or above (for a call) or at

6   or below (for a put) the option's cap price. This can also be referred to as a capped-style option.

7

8   *Real Estate Index Linked Cash-or-Nothing Call*: A type of option whose payoff is set to a

9   specified fixed price if the final asset price is above the strike price; if not, the payoff is set to

10   zero.

11

12   *Real Estate Index Linked Cash-or-Nothing Put*: A type of option whose payoff is set to a

13   specified fixed price if the final asset price is below the strike price; if not, the payoff is set to

14   zero.

15

16   *Real Estate Index Linked Chameleon Option*: An option that has the ability to change its

17   structure, should certain pre-determined terms of the contract be met. An example of a

18   chameleon option would be a put option that automatically changes into an identical call option

19   after the price of the underlying exceeds a certain price. This is similar to a long or short straddle

20   except investors are not required to open two positions.

21

22   *Real Estate Index Linked Chooser Option*: An option where the investor has the opportunity to

23   choose whether the option is a put or call at a certain point in time during the life of the option.

24   Also known as 'hermaphrodite option' or 'AC-DC option'.

25

26   *Real Estate Index Linked Cliquet*: An extended option that periodically settles and resets its

27   strike price at the level of the underlying during the time of settlement. For example, a 3 year

28   cliquet option with a strike of 1000 would expire worthless on the first year if the underlying was

29   to be 900. This value would then be the new strike for the following year and should the

30   underlying on settlement be 1200, the contract holder would receive a payout and the strike

1   would reset to this new level. Higher volatility provides better conditions for investors to earn

2   profits. Also known as a 'ratchet option' or 'cliquet option'.

3

4   *Real Estate Index Linked Compound Option*: An option on an option. Examples include a call

5   on a call, a put on a put, a call on a put, and a put on a call. This type of option usually exists for

6   currency or fixed income markets where an uncertainty exists regarding the option's risk

7   protection capabilities. Also known as a split-fee option.

8

9   *Real Estate Index Linked Contingent Option*: An option for which the holder only pays the

10   premium if the option is exercised. Contingent options are, therefore, a zero-cost option strategy,

11   unless exercised.

12

13   *Real Estate Index Linked Digital Option*: An option whose payout is fixed after the underlying

14   stock exceeds the predetermined threshold or strike price. The value of the payout is determined

15   at the onset of the contract and doesn't depend on the magnitude by which the underlying index's

16   price moves. So, should the investor be in the money by $1 or $5, the amount that the investor

17   will receive will be the same. These options are also referred to as binary or all-or-nothing

18   options.

19

20   *Real Estate Index Linked Double Barrier Option*: An option with two distinct triggers that

21   define the allowable range for the price fluctuation of the underlying asset. In order for the

22   investor to receive a payout, one of two situations must occur; the price must reach the range

23   limits (for a knock-in) or the price must avoid touching either limit (for a knock-out). A double

24   barrier option is a combination of two dependent knock-in or knock-out options. If one of the

25   barriers is reached in a double knock-out option, the option is killed. If one of the barriers is

26   reached in a double knock-in option, the option comes alive.

27

28   *Real Estate Index Linked Double No-Touch Option*: An option with two distinct triggers that

29   define the allowable range for the price fluctuation of the underlying asset. The double no-touch

30   option pays a fixed amount if the spot price never touches either of the two specified limits

31   (barrier levels). Factors that must be specified are the desired payoff, the currency pair, the

1   barrier price, and the expiration date. As long as the spot level never hits the two barrier levels,

2   the buyer / holder receives the payoff amount at expiry. If the barrier is reached during the

3   option period, the option expires worthless. An example of a double no-touch option is the

4   following:

5

6   Currency: USD / JPY

7   Barrier Price #1:   116

8   Barrier Price #2:   124

9   Current Spot Level:

10   Expiration Date: 2 months from today

11   Payoff: $7,000

12   Cost: $1,500

13   Net profit if barrier is reached: $5,500

14

15   If the spot value never reaches either barrier prior to expiry, then this option is profitable for the

16   buyer. If the spot value reaches either barrier prior to expiry, then there is no payoff at expiry,

17   and therefore this option is unprofitable for the buyer.

18

19   *Real Estate Index Linked Down-and-In Option*: An option that comes into existence when the

20   price of an underlying security sinks to a specified level.

21

22   *Real Estate Index Linked Down-and-Out Option*: An option that ceases to exist when the price

23   of an underlying security sinks to a specified level.

24

25   *Real Estate Index Linked Embedded Option*: An option that is an inseparable part of another

26   instrument. Compare this to a normal (or bare) option, which trades separately from the

27   underlying security. A common embedded option is the call provision in many corporate bonds.

28

29   *Real Estate Index Linked Employee Stock Option*: Stock options granted to specified employees

30   of a company. ESOs carry the right, but not the obligation, to buy a certain amount of shares in

31   the company at a predetermined price. ESOs are slightly different from regular options, because

23

1   they do not have puts and the holder typically must wait a specified period before he / she / it is

2   allowed to exercise the option. An Employee Stock Ownership Plan (ESOP) is an organized

3   plan for the employees of a company to buy shares of its stock (also known as a stock purchase

4   plan).

5

6   *Real Estate Index Linked Foreign Exchange Option (ELF-X)*: A put or call option that protects

7   an investor from foreign exchange risk for a future sale or purchase of a specified foreign equity

8   portfolio. ELF-X options are a combination of a currency option and an equity forward contract.

9   Should the exchange rate work in the investor's favor under the option contract, the total payout

10 received from the option is dependent upon the performance of the equities underlying the

11 contract. Otherwise, the investor does not receive a payout. For example, if an investor holds an

12 ELF-X call option on USD relative to CAD, and the Canadian dollar depreciates relative to the

13 American, the investor would not receive a payout. However, if USD depreciated relative to

14 CAD, the investor would receive the amount saved from use of the spot exchange rate in the

15 option contract and the foreign equity portfolio value, less the premium paid for the call option.

16 Also known as a "portfolio currency protection option" or PCPO.

17

18 *Real Estate Index Linked European Option*: An option that can only be exercised at the end of

19 its life. In other words, the holder must wait until the maturity date to exercise.

20

21 *Real Estate Index Linked Evergreen Option*: An employee option plan that grants additional

22 shares to the plan every year. The number of shares granted to the plan is determined by a set

23 percentage of the company's common shares outstanding. In most cases, these plans don't have

24 an expiry date and do not require shareholder approval. Also known as an evergreen plan.

25

26 *Real Estate Index Linked Exotic Option*: Any non-standard option. This is the opposite of a

27 "plain vanilla option."

28

29 *Real Estate Index Linked Flexible Exchange Option (FLEX)*: An option, generally written by

30 clearing houses, that can be modified regarding expiration dates, strike prices, or exercising

24

1 styles. Flex options provide flexibility to investors, as they can be tailored to meet their specific

2 needs.

3

4 *Real Estate Index Linked Incentive Stock Option (ISO)*: A type of employee stock option with a

5 tax benefit, when the holder exercises, of not having to pay ordinary income tax. Instead, the

6 options are taxed at a capital gains rate. Although ISOs have more favorable tax treatment than

7 NSOs, they also require the holder to take on more risk by having to hold onto the stock for a

8 longer period of time in order to receive the better tax treatment. Additionally, there are

9 numerous restrictions which have to be met in order to qualify as an ISO.

10

11 *Real Estate Index Linked Jump Option*: An option which is priced using a jump-diffusion

12 process.

13

14 *Real Estate Index Linked Knock-in Option*: An option which 'knocks-in' or begins to function as

15 a normal option once a certain price level is reached before expiration. Knock-ins are a type of

16 barrier option that may be either 'down and in' or 'up and in.'

17

18 *Real Estate Index Linked Knock-out Option*: An option with a built in mechanism to expire

19 worthless should a specified price level be exceeded.

20

21 *Real Estate Index Linked Ladder Option or Note*: An index or currency option or index-linked

22 note that provides an upward reset of its minimum payout when the underlying touches or trades

23 through certain steps or threshold levels or attains a certain level on designated reset dates. For

24 example, if the underlying trades through a price 35 percent above the strike, the holder of the

25 instrument may be guaranteed a minimum payout equal to the value of the instrument at that

26 price even if the index subsequently declines. A series of steps can ratchet the minimum payout

27 up the ladder, providing protection from a later decline in the index. Also called Lock-Step

28 Option, Step-Lock Option or Note, Cliquet Option, or Ratchet Option. Related to Infinite Ladder

29 Option and Shout Option.

30

1   *Real Estate Index Linked Long Term Equity Anticipation Securities (LEAPS)*: An options

2   contract that expires more than 9 months in advance, and can last as long as 2 years. Normal

3   options tend to last no longer than nine months. LEAPS are an excellent way to make a long

4   term option investment. LEAPS trade like normal options, but allow investors to benefit from

5   the appreciation of equities while placing a lot less money at risk than is required to purchase

6   stock.

7

8   *Real Estate Index Linked Lookback Option*: An exotic option that reduces uncertainties

9   associated with the timing of market entry. There are two types of lookback options: fixed and

10 floating.

11

12   • Fixed - the option's strike price is fixed at purchase. However, the underlying is priced at

13   its highest or lowest level, depending whether it is a call or put, during the life of the

14   option rather than expiring at market.

15   • Floating - the option's strike price is fixed at maturity. For a call the price is fixed at the

16   lowest price during the life of the option, for a put it is fixed at the highest price. The

17   option settles at market and against the floating strike.

18

19 *Real Estate Index Linked Mid-Atlantic Option*: An option that can be exercised at different times

20 during the life of the option. The various times set for exercise are written within the option and

21 allow for flexibility for both the writer and holder of the option. The Mid-Atlantic option is

22 named as such because its exercise dates are more flexible than European options and less

23 flexible than American options. Thus, it is in the middle, similar to the Atlantic Ocean being

24 between Europe and America. Mid-Atlantic options are also referred to as Bermuda, Quasi-

25 American, or Semi-American options.

26

27 *Real Estate Index Linked Naked Call Option*: An option where the writer of a call option does

28 not own a long position in the stock on which the call has been written. Naked options are very

29 risky. Profits are huge if the underlying asset moves in the direction desired by the buyer. On

30 the other hand, a writer / seller of a naked call option can lose big if the underlying asset moves

31 in the direction desired by the buyer. Sometimes referred to as an uncovered call.

1

2 *Real Estate Index Linked Naked Option*: An option position where the buyer or seller has no

3 underlying security position. Naked options are very risky. Profits are huge if the underlying

4 asset moves in the direction desired by the buyer. On the other hand, a writer / seller of a naked

5 option can lose big if the underlying asset moves in the direction desired by the buyer.

6

7 *Real Estate Index Linked Naked Put Option*: An option where the writer of a put option does not

8 have a short position in the stock on which the put has been written. Naked options are very

9 risky. Profits are huge if the underlying asset moves in the direction desired by the buyer. On

10 the other hand, a writer / seller of a naked put option can lose big if the underlying asset moves

11 in the direction desired by the buyer. Sometimes referred to as an uncovered put.

12

13 *Real Estate Index Linked Nonqualified Stock Options (NSO)*: A type of employee stock option

14 where the holder pays ordinary income tax on the difference between the grant price and the

15 price at which the holder exercises the option. NSOs are simpler and more common than ISOs.

16 They're called non-qualified stock options because they don't meet all of the requirements of the

17 Internal Revenue Code to be qualified as incentive stock options.

18

19 *Real Estate Index Linked No-Touch Options*: A no-touch option is a great way to profit from a

20 trending market. The no-touch option pays a fixed amount if the market never touches the

21 barrier level that the holder chooses. All the holder needs to do is to determine the desired

22 payoff, the currency pair, the barrier price, and the expiration date. As long as the spot level

23 never hits the barrier price before expiry, the holder receives the payoff amount. If the barrier is

24 reached during the option period, the option expires worthless. An example of a no-touch option

25 is the following:

26

27 Currency: EUR / USD

28 Barrier Price: 1.0625

29 Current Spot Level: 1.0550

30 Expiration Date: 7 days from today

31 Payoff: $3,000

| 1 | Cost: | $1,000 |
| 2 | Net profit if barrier is reached: | $2,000 |

3

4   If the spot value never reaches the relevant barrier prior to expiry, then this option is profitable

5   for the buyer. If the spot price reaches the relevant barrier prior to expiry, then there is no payoff

6   at expiry, and therefore this option is unprofitable for the buyer.

7

8   *Real Estate Index Linked Option*: A call or put option on a financial index. For example,

9   options on the S&P 500 are some of the most actively traded options in the world. This type of

10   option is a put or a call option based upon an underlying index. By way of example, the index

11   could be, but is not limited to, a Metropolitan or Micropolitan Statistical Area index or other real

12   estate index.

13

14   *Real Estate Index Linked Option Chain*: A way of quoting options prices through a list of all of

15   the options for a given security. It includes the various strike prices, expiration dates, and

16   whether they are calls or puts.

17

18   *Real Estate Index Linked Partial Lookback Option*: An option that provides a time window of,

19   say, 30 to 90 days, during which the strike price is set or reset at the most favorable level during

20   that period. After that period, the option is an ordinary American-style option. Because the

21   lookback characteristic covers a limited time, the partial lookback option will sell for a price

22   intermediate between a traditional option and a full lookback option. See also Lookback

23   Currency Option, Lookback Strike Option, Reset Option, or Step-Down Option.

24

25   *Real Estate Index Linked Path Dependant Option*: An exotic option that is valued according to

26   pre-determined price requirements for its underlying asset or commodity. The payoffs

27   associated with these options are determined by the path of the underlying asset's price.

28   Examples include Asian, Barrier and lookback options.

29

30   *Real Estate Index Linked Put Option*: A put option where the purchaser has the right, but not the

31   obligation, to sell a value as a strike price in the underlying index to the writer / seller of the

1   contract during a defined period of time at a fixed price, wherein the underlying index is a real

2   estate index with numerical values published at regular time intervals. The buyer profits on a put

3   when the underlying index decreases in value below the purchased value or strike price of the

4   option. A premium is paid by the investor / buyer / holder of the option to the writer / seller of

5   the option for this right. Settlement could require the exchange of the entire transaction value

6   between the buyer and writer / seller, or exchange of the strike price or index value of the

7   contract less the prevailing market index value of the underlying real estate index, times a cash

8   multiple.

9

10   *Real Estate Index Linked Quanto Option*: An option in one country's currency that pays out in

11   another country's currency. This is usually used when an investor believes that a stock will do

12   well in another country, but fears that the country's currency will not. The investor buys an

13   option in the foreign stock while keeping the payout in his or her home currency.

14

15   *Real Estate Index Linked Rainbow Option*: An option that is written on more than one

16   underlying asset. Rainbow options are usually calls or puts on the best or worst of n underlying

17   assets, or options which pay the best or worst of n assets. Rainbow options at exercise may

18   deliver either the best or worse asset in the rainbow or a call or put option on the better or worse

19   of the assets. "Multi-color" rainbow options could deliver the best or worst m of the n assets.

20   Spread options are a special case of rainbow options.

21

22   *Real Estate Index Linked Rebate Barrier Option*: A barrier option that offers a predetermined

23   rebate, should the option be 'knocked-out.' Should a rebate be enacted, it will be deducted from

24   the premium paid to the issuer, thus reducing the issuer's potential profit. For this reason, it is

25   uncommon to see a rebate opportunity attached to a barrier option.

26

27   *Real Estate Index Linked Reload Option*: An employee stock option that grants additional

28   options upon exercise of the original. The employee satisfies the exercise price of their current

29   option with shares rather than cash. The reload option will have the same expiry date as the

30   original option; however, the strike price will be equal to the share price at the time the original

31   option is exercised. Also known as a restoration option.

1

2 *Real Estate Index Linked Russian Option*: A lookback option without an expiry date. This type

3 of option can have either an American or a Mid-Atlantic settlement. It is a perpetual lookback

4 option.

5

6 *Real Estate Index Linked Shout Options*: An exotic option that allows the holder to lock in a

7 defined profit while maintaining the right to continue participating in gains without a loss of

8 locked in monies. Shout options can be structured so that holders of this contract have more than

9 one opportunity to "shout" or lock in profits. This allows holders to continue to benefit from

10 positive market movements without the possibility of losing already locked in profits due to

11 unfavorable conditions.

12

13 *Real Estate Index Linked Up-and-In Option*: The name for an option that exists only when the

14 price of its underlying asset has reached a pre-specified price level.

15

16 *Real Estate Index Linked Up-and-Out Option*: The name for an option that ceases to exist when

17 the price of its underlying asset has reached a pre-specified price level.

18

19 *Real Estate Index Linked Vanilla Option*: A normal option with no special or unusual features.

20 A "plain vanilla option" is a regular option, the opposite of which is an exotic option.

21

22 *Real Estate Index Linked Wild Card Option*: An option associated with treasury-bond or

23 treasury-note futures contracts that permits the short position to delay the delivery of the

24 underlying. This provision allows the short futures contract holder to announce his or her

25 intention to deliver the underlying securities on any notice day before a specified time, which is

26 later than the regular trading hours, in which invoice prices are normally fixed. The security that

27 is delivered is usually the cheapest to deliver on that specific day.

28

29 Real Estate Index Linked Caps, Collars, Corridors, and Floors

30

1   *Real Estate Index Linked Cap*: An upper limit on the interest rate on a floating-rate note (FRN)

2   or an adjustable-rate mortgage (ARM), or an upper limit on the value of a real estate index value

3   linked to a real estate index linked financial instrument.

4

5   *Real Estate Index Linked Collar*: An upper and lower limit on the interest rate on a floating-rate

6   note (FRN) or an adjustable-rate mortgage (ARM).

7

8   *Real Estate Index Linked Corridor*: A combination of a real estate index linked cap and a real

9   estate index linked floor in order to create a "corridor" within which the floating value of the

10 relevant real estate index (indices) linked instrument must remain within a specified period of

11 time in order to become "in the money".

12

13 *Real Estate Index Linked Floor*: A lower limit on the interest rate on a floating-rate note (FRN)

14 or an adjustable-rate mortgage (ARM), or a lower limit on the value of a real estate index value

15 linked to a real estate index linked financial instrument.

16

17 Real Estate Index Linked Notes

18

19 *Real Estate Index Linked Note*: Any debt security issued with either principal or interest

20 payments being determined by or linked to a real estate index.

21

22 Real Estate Index Linked Forwards and Futures

23

24 *Real Estate Index Linked Forward Contract*: A cash market transaction in which delivery of the

25 commodity is deferred until after the contract has been made. Although the delivery is made in

26 the future, the price is determined at the initial trade date. Most forward contracts don't have

27 standards and aren't traded on exchanges. A farmer would use a forward contract to "lock-in" a

28 price for his grain for the upcoming fall harvest. Note that real estate index-linked financial

29 instruments do not involve the actual delivery of a commodity, but instead involve settlement

30 based upon the change in value between the spot and forward prices. Settlement could require

31 the exchange of the entire transaction value between the buyer and writer / seller, or exchange of

1   the prevailing market value for the underlying index less the strike "price" or value of the

2   contract. Settlement could otherwise require the exchange of the entire transaction value

3   between the buyer and writer / seller, or exchange of the strike "price" or value of the contract

4   less the prevailing market value for the underlying index.

5

6   *Real Estate Index Linked Forward Rate Agreement (FRA)*: A forward contract that determines

7   an interest rate to be paid or received on an obligation beginning at a start date sometime in the

8   future. Also referred to as a "Future Rate Agreement." Any gain or loss on the agreement is like

9   a gain or loss on an option or futures contract.

10

11   *Real Estate Index Linked Futures Contract*: An exchange traded agreement to buy or sell a

12   particular type and grade of commodity for delivery at an agreed upon place and time in the

13   future. Futures contracts are transferable between parties. Commodity futures very rarely lead

14   to the delivery of a commodity because positions are usually closed out ("offset") before the

15   delivery date. In contrast, forward contracts often lead to delivery. Note that real estate index-

16   linked financial instruments do not involve the actual delivery of a commodity, but instead

17   involve settlement based upon the change in value between the spot and forward prices.

18   Settlement could require the exchange of the entire transaction value between the buyer and

19   writer / seller, or exchange of the prevailing market value for the underlying index less the strike

20   "price" or value of the contract. Settlement could otherwise require the exchange of the entire

21   transaction value between the buyer and writer / seller, or exchange of the strike "price" or value

22   of the contract less the prevailing market value for the underlying index.

23

24   *Real Estate Index Linked Managed Futures Account*: A managed futures account which

25   combines the different profiles of a variety of real estate index linked futures, forwards and

26   options on futures into a composite account or fund. Currently, managed futures are like a

27   mutual fund, except that positions in securities, futures contracts, and options on futures

28   contracts are used to manage the portfolio. Also known as a Commodity Pool.

29

30   Real Estate Index Linked Swaptions

31

1   *Real Estate Index Linked Swaption (Swap Option)*: The option to enter into an interest rate

2   swap. In exchange for an option premium, the buyer gains the right, but not the obligation, to

3   enter into a specified swap agreement with the issuer on a specified future date. The agreement

4   will specify whether the buyer of the swaption will be a fixed-rate receiver (like a call option on

5   a real estate index linked financial instrument) or a fixed-rate payer (like a put option on a real

6   estate index linked financial instrument). In such an option on a swap agreement, at least one, if

7   not both "legs", of the swap transaction are dependent on a real estate index in determining either

8   the coupon rate or the principal amount.

9

10   *Real Estate Index Linked Bermuda Swaption*: A swaption with predefined limitations on

11   exercise. Similar to a Bermuda option, a Bermuda swaption can only be exercised at certain

12   times during its life.

13

14   *Real Estate Index Linked Call Swaption*: A financial instrument which gives the buyer the right,

15   but not the obligation, to enter into a swap as a fixed-rate payer. The writer of the swaption

16   therefore becomes the fixed-rate receiver / floating-rate payer.

17

18   *Real Estate Index Linked Put Swaption*: A financial instrument which gives the buyer the right,

19   but not the obligation, to enter into a swap as a floating-rate payer. The writer of the swaption

20   therefore becomes the floating-rate receiver / fixed-rate payer.

21

22   Real Estate Index Linked Swaps

23

24   Swaps allow entities to exchange variable cash flows for fixed payments. They are similar to

25   options but no premium (i.e., up-front money) is paid to obtain the rights. It is essentially an

26   outright trade based on the expected movement of the price of the derivative's underlying

27   commodity, asset or index.

28

29   *Real Estate Index Linked Swap*: A swap agreement where at least one, if not both "legs" of the

30   swap transaction are dependent on a real estate index in determining either the interest rate,

31   coupon rate, the principal amount, or other financial element impacting one or both parties.

1 Traditionally, swaps involved the exchange of one security for another to change the maturity

2 (bonds), quality of issues (stocks or bonds), or because investment objectives had changed.

3 Recently, swaps have grown to include currency swaps and interest rates swaps. The other "leg"

4 of the swap may be dependent on, but not limited to, a fixed interest rate, floating interest rate,

5 currency exchange rate, equity index (e.g. S&P 500), commodity, or futures contract. If firms in

6 separate countries have comparative advantages on interest rates, then a swap could benefit both

7 firms. For example, one firm may have a lower fixed interest rate, while another has access to a

8 lower floating interest rate. These firms could swap to take advantage of the lower rates.

9

10 *Real Estate Index Linked Commodity Swap*: A swap where exchanged cash flows are dependent

11 on the price of an underlying commodity. In this swap, the user of a commodity would secure a

12 maximum price and agree to pay a financial institution this fixed price. Then in return, the user

13 would get payments based on the market price for the commodity involved. On the other side, a

14 producer wishes to fix his income and would agree to pay the market price to a financial

15 institution, in return for receiving fixed payments for the commodity.

16

17 *Real Estate Index Linked Interest Rate Swap*: A deal between banks or companies where

18 borrowers switch floating-rate loans for fixed rate loans (for example, in another country). These

19 can be either the same or different currencies. The advantage to this is that one company may

20 have access to lower fixed rates and another company may have access to lower floating rates,

21 which leads to a trade.

22

23 *Real Estate Index Linked Forward Swap*: A swap agreement created through the synthesis of

24 two different swaps, differing in duration, for the purpose of fulfilling the specific timeframe

25 needs of an investor. Sometimes swaps don't perfectly match the needs of investors wishing to

26 manage certain risks. For example, if an investor wants to offset risk for a five-year duration

27 beginning one year from today, they can enter into both a one-year and six-year swap, creating

28 the forward swap that meets the requirements for their portfolio. Also referred to as a Forward

29 Start Swap, Delayed Start Swap and a Deferred Start Swap.

30

1   *Real Estate Index Linked Index Amortizing Swap*: A swap whereby the notional principal
2   amount of the agreement is amortized according to the movement of an underlying rate. Index
3   amortizing swaps could be based on LIBOR or mortgage interest rates. Also known as "indexed
4   principal swap".
5
6   *Real Estate Index Linked Quanto Swap*: A dual swap combining a currency and / or interest rate
7   transaction (with payment rates or returns denominated in a currency different than the currency
8   used to state the notional principal amount, although both rates are calculated against the base
9   currency). The purpose behind a quanto swap is to minimize foreign exchange risk. This is
10 done by fixing the exchange rate and interest rate at the same time. This is also referred to as a
11 CRoss-Index Basis (CRIB) Swap, Cross-Rate Swap, CUrrency Protected Swap (CUPS), Diff or
12 Difference Swap, Differential Swap, Interest Rate Index Swap, LIBOR Differential Swap.
13
14 *Real Estate Index Linked Spreadlock*: An agreement that fixes the spread between the forward
15 price of an interest rate swap and its underlying government bond yield. The spreadlock allows a
16 future user of an interest rate swap to take advantage of the current spread between the swap rate
17 and the bond rate. This is achieved by transferring the current savings in basis points to a date in
18 the future, when both parties will enter the interest rate swap.
19
20 *Real Estate Index Linked Variance Swap*: A type of volatility swap where the payout is linear to
21 variance rather than volatility. Therefore, the payout will rise at a higher rate than volatility.
22 Variance is the square of standard deviation. Because of this, the payout of a variance swap will
23 be larger than that of a volatility swap, as these products are based upon variance rather than
24 standard deviation.
25
26 *Real Estate Index Linked Volatility Swap*: A forward contract whose underlying is the volatility
27 of a given product. This is a pure volatility instrument, allowing investors to speculate solely
28 upon the movement of an index's or indices' volatility without the influence of price. Thus, just
29 like investors trying to speculate on the prices of stocks, by using this instrument investors are
30 able to speculate on how volatile the index or indices will be.
31

1   Additional Terms and Conditions Applicable To Real Estate Index Linked Financial Instruments

2

3   It is a feature of the present invention that each type of real estate index linked financial

4   instrument bears a unique identification number. A second number may be assigned to each

5   contract of a particular type of said real estate index linked financial instrument.

6

7   In one embodiment of the present invention, contracts of a real estate index linked financial

8   instrument may be combined with each other to form more complex financial products.

9   Contracts of real estate index linked financial instruments may also be combined with other

10   financial securities or indices to form more complex financial products. The other financial

11   securities or indices include, but are not limited to, commodity futures and forwards, other

12   indices such as the S&P 500, foreign exchange rates, domestic and foreign interest rates, equity

13   securities, equity-linked securities or derivatives, equity-linked indices, fixed-income securities,

14   fixed-income-linked securities or derivatives, and fixed-income-linked indices, and fixed-

15   income-linked indices. For example, one embodiment of the present invention involves real

16   estate loans that currently do not meet federal regulatory requirements under FFIEC (Federal

17   Financial Institutions Examination Council) compliance criteria for being repackaged as

18   securities. With the present invention, those loans which currently fail FFIEC criteria for

19   securitization may be combined with real estate index-linked financial instruments to change

20   their characteristics and meet FFIEC compliance criteria for securitization and subsequent

21   trading in financial markets.

22

23   It is also an embodiment of the present invention that additional terms may be added to the

24   documented set of terms that correspond to a real estate index linked option, future or other

25   security. Such additional terms may address subjects including but not limited to: risk

26   premiums; financial guarantees and / or covenants; guarantees of compliance with rules,

27   conditions, and disclosure as set forth by the SEC, FASB, OFAC, and other regulatory bodies

28   with oversight of capital markets; conformance to pre-determined financial measures (including

29   but not limited to a specified debt-to-equity ratio, a specified quick ratio or quick asset ratio, and

30   / or a specified net worth); and compliance with legal requirements for: ethical conduct in the

31   ordinary course of business; corporate governance; sound financial management to fulfill

1   obligations for the relevant real estate index linked financial instrument; board structure;

2   disclosure of financial condition; and conflicts of interest.

3

4   It is a further embodiment of the present invention that additional risk definitions and

5   contingency plans may be added to the documented set of terms that correspond to a real estate

6   index linked option, future or other security. The additional risk definitions and contingency

7   plans may address subjects including but not limited to: potential counterparty risk, potential

8   home market risk, potential currency risk, potential sovereign / provisional / territorial

9   government risk, potential political risk, potential agency risk (government-chartered and / or

10   non-governmental), potential trading and exchange risk, and / or potential syndicate risk.

11

12   It is a further embodiment of the present invention that financial guarantees may be "wrapped"

13   or included in the terms of a real estate index linked financial instrument. Such guarantees as

14   Letters of Credit (LOC) have a Beneficiary, Obligor, and Guarantor. A Beneficiary requests an

15   LOC from an Obligor as a guarantee against credit exposure. The Obligor will obtain the LOC

16   from a Guarantor in favor of the Beneficiary. LOCs may be drawn against based on contractual

17   provisions. By way of example, financial guarantees include, but are not limited to, the

18   following:

19

20   *Asset Value Guarantee*--Guarantee asset value at a specific time, such as in aircraft leasing.

21   *Bid Bond*--To secure an offer to perform a task at a specified price.

22   *Bond Guarantee*--The obligation of one person to repay a debt taken on by someone else, should

23   that person default.

24   *Capital Guarantee*--Guarantee an agreed upon level of equity.

25   *Certificate of Insurance*--Evidence of the existence of an insurance policy issued by the issuer of

26   the policy.

27   *Comfort Letter*--Letter guaranteeing payment of obligations.

28   *Commercial Paper Guarantee*--Short term obligations issued to investors with temporarily idle

29   cash.

30   *Credit Guarantees*--Guarantees the repayment of debt by the obligor.

1 *Equity Swap*--Notational principal swap in which the cash flows on at least one leg of the swap

2 are linked to the total return on a single stock, a stock index, or some combination thereof.

3 *Evergreen Provision*--Refers to a provision for automatic roll-over of the LOC unless very

4 specific conditions are met. LOC amounts are reviewed and reset on (generally) an annual basis

5 to reflect changes in underlying exposure.

6 *Financial Guarantee Insurance*--Insurance created to cover losses from specified financial

7 transactions.

8 *Funding*--Agreement to provide funds to finance a project or debt on or before maturity.

9 *Guarantee*--Guarantee payment of and/or performance of obligations.

10 *Guarantee Letter*--Guarantees commitment that the Obligor will have working capital at all

11 times to meet obligations.

12 *Hell-or-High-Water Contract*--A non-cancelable contract whereby the purchaser must make the

13 specified payments to the seller, regardless of any difficulties they may encounter. Hell-or-high-

14 water clauses bind the purchaser or lessee to the terms of the contract until the contract's

15 expiration. Also known as a 'promise to pay' contract.

16 *Indemnification*--Guarantee to restore to the condition prior to the loss

17 *Irrevocable Letter of Credit*--Issued by a bank guaranteeing the payment of a customer's drafts

18 up to the stated amount for a specified period that cannot be changed or terminated without the

19 agreement of the beneficiary.

20 *Irrevocable Standby Letter of Credit*--Issued by a bank guaranteeing the payment of a customer's

21 drafts up to the stated amount for a specified period for a particular event that cannot be changed

22 or terminated without the agreement of the beneficiary.

23 *Keepwell Agreement*--Guarantee residual values, payments, obligations, net worth as agreed.

24 *Lease / Rent Guarantee*--Guarantee real property lease and rent payments.

25 *Letter of Comfort (by Italian Law is a Guaranty)*--Guarantee residual values, payments,

26 obligations, net worth as agreed, under Italian law.

27 *Letter of Credit*--Issued by a bank guaranteeing the payment of a customer's drafts up to the

28 stated amount for a specified period.

29 *Loss Guarantees on Construction Loans*--Agreement to share losses with the beneficiary.

30 *Payment Obligations*--Guarantee payment obligations of the obligor.

31 *Performance Obligations*--Guarantee performance of policy obligations.

1   *Policyholder Obligations*--Fulfillment of insurance contract and to maintain rating from Agency

2   Standard and Poor's.

3   *Standby Letter of Credit*--Issued by a bank guaranteeing the payment of a customer's drafts up to

4   the stated amount for a specified period for a particular event.

5   *Surety*--A formal pledge to secure against loss.

6   *Tender Guarantee*--Offer of money or goods in settlement of a prior debt or claim.

7   *Trust Agreement*--A trust agreement is made and entered into by the beneficiary, the grantor

8   (obligor) and a bank (Guarantor). A trust account is created into which assets are deposited.

9   *Other Guarantees*--All other financial guarantees.

10

11   The information stated in a financial guarantee may include, but is not limited to: naming of

12   Beneficiaries, Obligors, and Guarantors; contact information such as mailing address and phone

13   numbers; notional drawdown amounts; credit ratings and impacts of credit upgrades or

14   downgrades; currency or currencies of denomination; expiry / renewal date if relevant;

15   compliance notes such as dates for regulatory disclosure of commercial commitments or marking

16   and reporting losses for off-balance sheet obligations; the identification of associated collateral;

17   and other information that affects the structure of a financial guarantee.

18

19   2.   Real Estate Indices

20

21   Real Estate Index Linked financial instruments (such as real estate index linked options, real

22   estate index linked futures, and other real estate index linked securities) utilize a real estate index

23   (instead of a stock or bond price) as the underlying value upon which the financial instrument's

24   value is computed. These real estate indices are published by sources mentioned previously in

25   this document, and exist for localities, cities, regions, states, nations, or multinational /

26   international areas. Within the United States, real estate index numbers are available for

27   Metropolitan and Micropolitan Statistical Areas (MSAs). Although the present invention will be

28   discussed with regards to the nomenclature employed within the United States, it should in no

29   way be construed that the present invention is limited only to financial instruments based upon

30   real estate indices published within the United States. In fact, as will be readily apparent to one

31   skilled in the art(s), the present invention can easily be applied to utilize real estate index

1　information published anywhere in the world, and real estate index linked financial instruments

2　could easily be created and traded in capital markets anywhere in the world. The present

3　invention may also be applied across existing metrics for classifying regions, such as, but not

4　limited to, mailing codes, parishes, cantons, and other statistical forms of subdividing areas upon

5　which real estate indices may be based.

6　Metropolitan Statistical Areas

7

8　The general concept of a metropolitan area (MA) is one of a large population nucleus, together

9　with adjacent communities that have a high degree of economic and social integration with that

10　nucleus.

11

12　Each MA must contain either a place with a minimum population of 50,000 or a Census Bureau-

13　defined urbanized area and a total MA population of at least 100,000. A MA comprises one or

14　more counties. A MA may also include one or more outlying counties that have close economic

15　and social relationships with the central county. An outlying county must have a specified level

16　of commuting to the central counties and also must meet certain standards regarding

17　metropolitan character, such as population density, urban population, and population growth.

18

19　Primary Metropolitan Statistical Area (PMSA)

20

21　If an area that qualifies as an MA has more than one million persons, primary metropolitan

22　statistical areas (PMSA) may be defined within it. PMSAs consist of a large urbanized county or

23　cluster of counties that demonstrate very strong internal economic and social links, in addition to

24　close ties to other portions of the larger area. When PMSAs are established, the larger area of

25　which they are component parts is designated a consolidated metropolitan statistical area

26　(CMSA).

27

28　Metropolitan Statistical Area (MSA)

29

30　Metropolitan statistical areas (MSAs) are relatively freestanding MAs and are not closely

31　associated with other MAs. These areas typically are surrounded by nonmetropolitan counties.

40

1

2 The United States Office of Management and Budget (OMB) defines metropolitan and

3 micropolitan statistical areas according to published standards that are applied to Census Bureau

4 data. The general concept of a metropolitan or micropolitan statistical area is that of a core area

5 containing a substantial population nucleus, together with adjacent communities having a high

6 degree of economic and social integration with that core. Currently defined metropolitan and

7 micropolitan statistical areas are based on application of 2000 standards (which appeared in the

8 *Federal Register* on December 27, 2000) to 2000 decennial census data. Current metropolitan

9 and micropolitan statistical area definitions were announced by OMB effective June 6, 2003.

10

11 Standard definitions of metropolitan areas were first issued in 1949 by the then Bureau of the

12 Budget (predecessor of OMB), under the designation "standard metropolitan area" (SMA). The

13 term was changed to "standard metropolitan statistical area" (SMSA) in 1959, and to

14 "metropolitan statistical area" (MSA) in 1983. The term "metropolitan area" (MA) was adopted

15 in 1990 and referred collectively to metropolitan statistical areas (MSAs), consolidated

16 metropolitan statistical areas (CMSAs), and primary metropolitan statistical areas (PMSAs). The

17 term "core based statistical area" (CBSA) became effective in 2000 and refers collectively to

18 metropolitan and micropolitan statistical areas.

19

20 OMB has been responsible for the official metropolitan areas since they were first defined,

21 except for the period 1977 to 1981, when they were the responsibility of the Office of Federal

22 Statistical Policy and Standards, Department of Commerce. The standards for defining

23 metropolitan areas were modified in 1958, 1971, 1975, 1980, 1990, and 2000.

24

25 Defining Metropolitan and Micropolitan Statistical Areas

26

27 The 2000 standards provide that each CBSA must contain at least one urban area of 10,000 or

28 more population. Each metropolitan statistical area must have at least one urbanized area of

29 50,000 or more inhabitants. Each micropolitan statistical area must have at least one urban

30 cluster of at least 10,000 but less than 50,000 population.

31

1   Under the standards, the county (or counties) in which at least 50 percent of the population

2   resides within urban areas of 10,000 or more population, or that contain at least 5,000 people

3   residing within a single urban area of 10,000 or more population, is identified as a "central

4   county" (counties). Additional "outlying counties" are included in the CBSA if they meet

5   specified requirements of commuting to or from the central counties. Counties or equivalent

6   entities form the geographic "building blocks" for metropolitan and micropolitan statistical areas

7   throughout the United States and Puerto Rico.

8

9   If specified criteria are met, a metropolitan statistical area containing a single core with a

10   population of 2.5 million or more may be subdivided to form smaller groupings of counties

11   referred to as "metropolitan divisions."

12

13   As of June 6, 2000, there are 362 metropolitan statistical areas and 560 micropolitan statistical

14   areas in the United States. In addition, there are 8 metropolitan statistical areas and 5

15   micropolitan statistical areas in Puerto Rico.

16

17   Principal Cities and Metropolitan and Micropolitan Statistical Area Titles

18

19   The largest city in each metropolitan or micropolitan statistical area is designated a "principal

20   city." Additional cities qualify if specified requirements are met concerning population size and

21   employment. The title of each metropolitan or micropolitan statistical area consists of the names

22   of up to three of its principal cities and the name of each state into which the metropolitan or

23   micropolitan statistical area extends. Titles of metropolitan divisions also typically are based on

24   principal city names but in certain cases consist of county names.

25

26   Defining New England City and Town Areas

27

28   In view of the importance of cities and town in New England, the 2000 standards also provide

29   for a set of geographic areas that are defined using cities and towns in the six New England

30   states. The New England city and town areas (NECTAs) are defined using the same criteria as

31   metropolitan and micropolitan statistical areas and are identified as either metropolitan or

42

1   micropolitan, based, respectively, on the presence of either an urbanized area of 50,000 or more

2   population or an urban cluster of at least 10,000 but less than 50,000 population. If the specified

3   criteria are met, a NECTA containing a single core with a population of at least 2.5 million may

4   be subdivided to form smaller groupings of cities and towns referred to as New England city and

5   town area divisions.

6

7   <u>Changes in Definitions over Time</u>

8

9   Changes in the definitions of these statistical areas since the 1950 census have consisted chiefly

10   of:

11   the recognition of new areas as they reached the minimum required city or urbanized area

12   population, and

13   the addition of counties (or cities and towns in New England) to existing areas as new decennial

14   census data showed them to qualify.

15

16   In some instances, formerly separate areas have been merged, components of an area have been

17   transferred from one area to another, or components have been dropped from an area. The large

18   majority of changes have taken place on the basis of decennial census data. However, Census

19   Bureau data serve as the basis for intercensal updates in specified circumstances.

20

21   Because of these historical changes in geographic definitions, users must be cautious in

22   comparing data for these statistical areas from different dates. For some purposes, comparisons

23   of data for areas as defined at given dates may be appropriate; for other purposes, it may be

24   preferable to maintain consistent area definitions. Historical metropolitan area definitions are

25   available for 1999, 1993, 1990, 1983, 1981, 1973, 1970, 1963, 1960, and 1950. For more

26   information, contact the Population Distribution Branch at (301) 763-2419.

27

28   Conventional Mortgage Home Price Index: MSA Series, Q1 2003 Release (Source: Freddie

29   Mac)

30

31   AKRON OH PMSA

1   ALBANY-SCHENECTADY-TROY NY MSA

2   ALBUQUERQUE NM MSA

3   ALLENTOWN-BETHLEHEM-EASTON PA MSA

4   ANCHORAGE AK MSA

5   ANN ARBOR MI PMSA

6   APPLETON-OSHKOSH-NEENAH WI MSA

7   ATLANTA GA MSA

8   ATLANTIC-CAPE MAY NJ PMSA

9   AUGUSTA-AIKEN GA-SC MSA

10 AUSTIN-SAN MARCOS TX MSA

11 BAKERSFIELD CA MSA

12 BALTIMORE MD PMSA

13 BARNSTABLE-YARMOUTH MA MSA

14 BATON ROUGE LA MSA

15 BELLINGHAM WA MSA

16 BERGEN-PASSAIC NJ PMSA

17 BIRMINGHAM AL MSA

18 BLOOMINGTON-NORMAL IL MSA

19 BOISE CITY ID MSA

20 BOSTON MA-NH PMSA

21 BOULDER-LONGMONT CO PMSA

22 BREMERTON WA PMSA

23 BRIDGEPORT CT PMSA

24 BROCKTON MA PMSA

25 BUFFALO-NIAGARA FALLS NY MSA

26 BURLINGTON VT MSA

27 CANTON-MASSILLON OH MSA

28 CEDAR RAPIDS IA MSA

29 CHARLESTON-NORTH CHARLESTON SC MSA

30 CHARLOTTE-GASTONIA-ROCK HILL NC-SC MSA

31 CHATTANOOGA TN-GA MSA

1   CHICAGO IL PMSA

2   CINCINNATI OH-KY-IN PMSA

3   CLEVELAND-LORAIN-ELYRIA OH PMSA

4   COLORADO SPRINGS CO MSA

5   COLUMBIA SC MSA

6   COLUMBUS OH MSA

7   DALLAS TX PMSA

8   DANBURY CT PMSA

9   DAVENPORT-MOLINE-ROCK ISLAND IA-IL MSA

10   DAYTON-SPRINGFIELD OH MSA

11   DAYTONA BEACH FL MSA

12   DENVER CO PMSA

13   DES MOINES IA MSA

14   DETROIT MI PMSA

15   EUGENE-SPRINGFIELD OR MSA

16   EVANSVILLE-HENDERSON IN-KY MSA

17   FLINT MI PMSA

18   FORT COLLINS-LOVELAND CO MSA

19   FORT LAUDERDALE FL PMSA

20   FORT MYERS-CAPE CORAL FL MSA

21   FORT WAYNE IN MSA

22   FORT WORTH-ARLINGTON TX PMSA

23   FRESNO CA MSA

24   GARY IN PMSA

25   GRAND RAPIDS-MUSKEGON-HOLLAND MI MSA

26   GREEN BAY WI MSA

27   GREENSBORO-WINSTON-SALEM-HIGH POINT MSA

28   GREENVILLE-SPARTANBURG-ANDERSON SC MSA

29   HAMILTON-MIDDLETOWN OH PMSA

30   HARRISBURG-LEBANON-CARLISLE PA MSA

31   HARTFORD CT PMSA

1	HONOLULU HI MSA
2	HOUSTON TX PMSA
3	HUNTSVILLE AL MSA
4	INDIANAPOLIS IN MSA
5	JACKSON MS MSA
6	JACKSONVILLE FL MSA
7	JANESVILLE-BELIOT WI MSA
8	KALAMAZOO-BATTLE CREEK MI MSA
9	KANSAS CITY MO-KS MSA
10	KNOXVILLE TN MSA
11	LANCASTER PA MSA
12	LANSING-EAST LANSING MI MSA
13	LAS VEGAS NV-AZ MSA
14	LAWRENCE MA-NH PMSA
15	LEXINGTON KY MSA
16	LINCOLN NE MSA
17	LITTLE ROCK-NORTH LITTLE ROCK AR MSA
18	LOS ANGELES-LONG BEACH CA PMSA
19	LOUISVILLE KY-IN MSA
20	LOWELL MA-NH PMSA
21	MACON GA MSA
22	MADISON WI MSA
23	MANCHESTER NH PMSA
24	MELBOURNE-TITUSVILLE-PALM BAY FL MSA
25	MEMPHIS TN-AR-MS MSA
26	MIAMI FL PMSA
27	MIDDLESEX-SOMERSET-HUNTERDON NJ PMSA
28	MILWAUKEE-WAUKESHA WI PMSA
29	MINNEAPOLIS-ST. PAUL MN-WI MSA
30	MODESTO CA MSA
31	MONMOUTH-OCEAN NJ PMSA

1   NASHUA NH PMSA

2   NASHVILLE TN MSA

3   NASSAU-SUFFOLK NY PMSA

4   NEW HAVEN-MERIDEN CT PMSA

5   NEW ORLEANS LA MSA

6   NEW YORK NY PMSA

7   NEWARK NJ PMSA

8   NORFOLK-VIRGINIA BEACH-NEWPORT NEWS MSA

9   OAKLAND CA PMSA

10 OKLAHOMA CITY OK MSA

11 OLYMPIA WA PMSA

12 OMAHA NE-IA MSA

13 ORANGE COUNTY CA PMSA

14 ORLANDO FL MSA

15 PEORIA-PEKIN IL MSA

16 PHILADELPHIA PA-NJ PMSA

17 PHOENIX-MESA AZ MSA

18 PITTSBURGH PA PMSA

19 PORTLAND-VANCOUVER OR-WA PMSA

20 PROVIDENCE-FALLS RIVER-WARWICK RI-MA MSA

21 PROVO-OREM UT MSA

22 RACINE WI PMSA

23 RALEIGH-DURHAM-CHAPEL HILL NC MSA

24 READING PA MSA

25 RENO NV MSA

26 RICHMOND-PETERSBURG VA MSA

27 RIVERSIDE-SAN BERNARDINO CA PMSA

28 ROANOKE VA MSA

29 ROCHESTER NY MSA

30 ROCKFORD IL MSA

31 SACRAMENTO CA PMSA

1	SAGINAW-BAY CITY-MIDLAND MI MSA
2	ST. LOUIS MO-IL MSA
3	SALEM OR PMSA
4	SALINAS CA MSA
5	SALT LAKE CITY-OGDEN UT MSA
6	SAN ANTONIO TX MSA
7	SAN DIEGO CA MSA
8	SAN FRANCISCO CA PMSA
9	SAN JOSE CA PMSA
10	SAN LUIS OBISPO-ATASCADERO-PASO ROBL MSA
11	SANTA BARBARA-SANTA MARIA-LOMPOC CA MSA
12	SANTA CRUZ-WATSONVILLE CA PMSA
13	SANTA FE NM MSA
14	SANTA ROSA CA PMSA
15	SARASOTA-BRADENTON FL MSA
16	SEATTLE-BELLEVUE-EVERETT WA PMSA
17	SPOKANE WA MSA
18	SPRINGFIELD IL MSA
19	SPRINGFIELD MA MSA
20	STAMFORD-NORWALK CT PMSA
21	STOCKTON-LODI CA MSA
22	SYRACUSE NY MSA
23	TACOMA WA PMSA
24	TAMPA-ST. PETERSBURG-CLEARWATER FL MSA
25	TOLEDO OH MSA
26	TRENTON NJ PMSA
27	TUCSON AZ MSA
28	TULSA OK MSA
29	VALLEJO-FAIRFIELD-NAPA CA PMSA
30	VENTURA CA PMSA
31	VISALIA-TULARE-PORTERVILLE CA MSA

1 WASHINGTON DC-MD-VA-WV PMSA

2 WEST PALM BEACH-BOCA RATON FL MSA

3 WICHITA KS MSA

4 WILMINGTON-NEWARK DE-MD PMSA

5 WORCESTER MA-CT PMSA

6 YOLO CA PMSA

7 YORK PA MSA

8

9 It should be noted that for such real estate index linked financial instruments to operate in an

10 open market, parties have to agree on the precise index to be used, as the next published numbers

11 of this index will trigger a change in value of the financial instruments. Furthermore, it will be

12 apparent to one skilled in the relevant art(s) the parties may need to define all terms of the

13 contract within the contract itself to avoid legal disputes. It should also be noted that prices on

14 real estate index linked financial instruments may be quoted in either fraction or decimal

15 formats.

16

17 Derivatives, being financial instruments, may be traded among investors as are stocks, bonds,

18 and the like. Thus, in order to trade derivatives, there must be a mechanism to price them so that

19 traders may exchange them in an open market. To date, there is no organized exchange for real

20 estate index linked financial instruments (or derivates, as they may be alternately referred to in

21 these descriptions of the present invention), as they are traded as over-the-counter (OTC)

22 instruments, typically between two counterparties conducting a private transaction not open to

23 other investors. The present invention of real estate index linked financial instruments would be

24 made available via exchanges (both electronic and open outcry), ECNs (electronic commerce

25 networks such as Instinet or Archipelago), broker / dealer networks (e.g. Everen Securities) and

26 via OTC (over the counter) transactions and via private transactions between two or more

27 counterparties or legal entities.

28

29 The relationship between the value of a derivative and the underlying asset are not linear and can

30 be very complex. Economists have developed pricing models in order to perform valuation of

31 certain types of derivatives. As is well known in the relevant art(s), the Black-Scholes option

1 pricing model is the most influential and extensively used pricing model. The Black-Scholes

2 model is based on stochastic calculus and is described in detail in a variety of publicly available

3 documents, such as Chriss, Neil A., The Black-Scholes and Beyond Interactive Toolkit: A Step-

4 by-Step Guide to In-depth Option Pricing Models, McGraw-Hill, 1997, ISBN: 078631026X

5 (USA), which is incorporated herein by reference in its entirety.

6

7 Whether using the Black-Scholes or any other pricing model, each has inherent flaws and thus

8 poses risks. It has been estimated that some 40% of losses in dealing with derivatives can be

9 traced to problems related to pricing models. Risks in relying on any model include errors in the

10 model's underlying assumptions, errors in calculation when using the model, and failure to

11 account for variables (i.e., occurrences) that may affect the underlying assets.

12 Real estate indices, and more specifically future expected movement in such indices, have not

13 yet been an area of application for pricing models. The few models that have considered real

14 estate prices usually have only considered past (i.e., historical) real estate price or index data.

15 That is, most models assume, for example, that real estate prices are cyclical in nature.

16 Historical analysis has shown, however, that this assumption does not always hold true. Thus,

17 regardless of the index or instrument, risk management trading techniques or vehicles, traders

18 essentially have been operating in the "blind" without knowledge of real estate predicted future

19 index movements.

20

21 Therefore, given the fact that real estate index linked financial instruments and / or derivatives

22 have been overlooked in the development of financial products, existing models have considered

23 past real estate indices, and also with respect to the newly-developed present invention described

24 in this document, what is needed is a mechanism to price real estate index-linked financial

25 instruments so that parties may exchange them in an open market. The mechanisms used to

26 price real estate-linked financial instruments may include, but is not limited to, the following:

27 1. Black-Scholes Option Pricing Model

28 2. Binomial Lattice Models

29 3. Trinomial Lattice Models

30 4. Monte Carlo Simulations

1

2   Black-Scholes Model

3

4   The Black-Scholes model developed in 1972 was the original option-pricing model for the

5   valuation of European style options. European style options are options that have as a

6   characteristic that they cannot be exercised before the expiration date. Its principles serve as the

7   foundation in almost all options formulas used today.

8

9   Fischer Black and Myron Scholes developed their option pricing model under the assumptions

10   that the underlying prices change continuously and that the returns of the underlying follow a

11   log-normal distribution. Also, they assume that the interest rate and the volatility of the

12   underlying remain constant over the life of the option.

13

14   The Black-Scholes model as originally developed pertained only to options on underlying with

15   no dividend payment. The calculator used here has been adjusted for the Black-Scholes model to

16   account for dividends.

17

18   The Black-Scholes equation is usually written as $C = S*N(d_1) - Ke^{-(rt)}*N(d_2)$, where the notation is

19   fairly standard, as described by P. Wilmott, J. N. Dewynne and S. Howison, "Option Pricing:

20   Mathematical Models and Computation", Oxford Financial Press, Oxford (1993).

21

22   Binomial Option Pricing Model

23

24   An option pricing model in which the underlying asset can assume one of only two possible,

25   discrete values in the next time period for each value that it can take on in the preceding time

26   period. This is a simple model used to price options by reducing possibilities of price changes,

27   removing the possibility for arbitrage, assuming perfectly efficient markets, and shortening the

28   duration of the option. The binomial approach assumes a risk neutral approach to valuation,

29   assuming that underlying security prices can only increase or decrease with time until the option

30   expires worthless.

1

2   The binomial model, developed by Cox and Rubinstein, breaks down the time to expiration into

3   potentially a very large number of time intervals, or steps. A tree of the underlying prices is

4   initially produced working forward from the present to expiration.

5

6   At each step it is assumed that the underlying price will move up or down by an amount

7   calculated using volatility and time to expiration. This produces a binomial distribution, or

8   recombining tree, of underlying prices. The tree represents all the possible paths that the

9   underlying price could take during the life of the option. At the end of the tree -- i.e. at

10 expiration of the option -- all the terminal option prices for each of the final possible stock prices

11 are known, as they simply equal their intrinsic values.

12

13 The option prices at each step of the tree are calculated working back from expiration to the

14 present. The option prices at each step are used to derive the option prices at the next step of the

15 tree using risk neutral valuation based on the probabilities of the underlying prices moving up or

16 down, the risk free rate and the time interval of each step. At the top of the tree there will only

17 be left one option price, which is known as the theoretical or fair value of the option.

18

19 For European options, the binomial model converges on the Black-Scholes formula as the

20 number of steps in the binomial calculation increases. In fact the Black-Scholes model for

21 European options is really a special case of the binomial model where the number of binomial

22 steps is infinite. In other words, the binomial model provides discrete approximations to the

23 continuous process underlying the Black-Scholes model.

24

25 To derive the formula for Binomial pricing model, begin by dividing the life of an option into a

26 large number of small time intervals of length dt. Assuming that the initial value of the index is

27 S, the value S can increase to S_u or decrease to S_d when comes to the next time interval. Hence

28 index can move from its initial value of S to one of two new values, S_u and S_d. The movement

29 from S to S_u is therefore an "up" movement and the movement from S to S_d is a "down"

30 movement. The probability of an up movement will be denoted by p while the probability of a

31 down movement is (1-p).

1

2 <u>Trinomial Model</u>

3

4 The Trinomial Model is very similar to the Binomial Model except that at each time interval it is

5 assumed that the underlying index (S) will move up (S_u) or down (S_d) by an amount or remain

6 the same (S). The initial index level, interest rates and the volatility define the nature of the

7 trinomial lattice. If the probability of an up movement is denoted as p_u while the probability of a

8 down movement is denoted by p_d, the probability for the across movement will be ($1-p_u-p_d$).

9

10 Once the array of the underlying index has been set up by working forwards through the

11 trinomial tree, the option price array is calculated by working backwards from the option expiry.

12 At option expiry, the options are initialized to their intrinsic value. In discounting back from the

13 expiry to the present, the option price at each interval is calculated as the minimum of the

14 exercise (strike) price and the discounted value of holding the option over the time period. Once

15 the option price array has been populated, the theoretical (fair) option value is the value of the

16 option at t=0 or at present.

17

18 <u>Monte Carlo Simulation</u>

19

20 An analytical technique for solving a problem by performing a large number of trial runs, called

21 simulations, to analyze the effect of varying inputs on the outputs of a model, such as a stock

22 price. The simulations will infer a solution from the collective results of the trial runs. The

23 Monte Carlo simulation randomly generates values for uncertain variables over and over to

24 simulate a model, and calculates the probability distribution of possible outcomes.

25

26 <u>Other Methods</u>

27

28 While Black-Scholes model is a popular model used for option pricing, other models exist that

29 consider different factors. No model can be entirely accurate. The pricing models used here are

30 not intended to provide a complete list of methodologies for valuing financial instruments, but

31 rather as an exploration of the many ways in which financial instruments can be assessed in order

1   for a trader to determine whether an instrument is a desirable investment or not. In fact, as will

2   be readily apparent to those skilled in the relevant art(s), there are a multitude of methodologies,

3   formulae and pricing models by which one can determine whether a financial instrument is over-

4   , under- or fairly priced when compared with its market value. Examples of alternative

5   methodologies would include, but are not limited to, closed form solutions and neural networks.

6

7   Also, as a workflow to be included in a preferred embodiment of the present invention, "black

8   box" computer programs may be used, wherein the user enters information and the system

9   utilizes pre-programmed logic (e.g. formulas, calculations) to return output to the user, which

10   may include by way of example buy or sell signals and other optimal or useful information

11   output.

12

13   <u>Option Model Inputs</u>

14

15   By way of example, there are eight inputs for a call or put option:

16

17   Option Type: A Call or a Put

18   -Underlying Price: Value of the underlying index or indices, e.g. Atlanta MSA

19   Exercise Price of Option: Strike price of the Option e.g. 140

20   Dividend Yield: In percentage. e.g. 1.72%

21   Interest Rate: In percentage. e.g. 3.12%

22   Volatility: In percentage. e.g. 25%

23   Valuation Date: e.g. 9-Oct-04

24   Exercise Date: e.g. 7-Jan-05

25

26   Other types of real estate index linked financial instruments may require additional inputs.

27

28   Additional valuation measures like Intrinsic Value, Time Value and Implied Volatility of real

29   estate index linked financial instruments will be calculated immediately upon input of the

30   financial instrument's market value.

31

1   Intrinsic Value and Time Value

2

3   The intrinsic value of a call is the amount by which the index is above the call's strike price. The

4   intrinsic value of a put is the amount by which the index is below the put's exercise price. Time

5   value is that portion of an option's total price in excess of intrinsic value. As the intrinsic value

6   increases, the time value decreases.

7

8   Consider the following illustration: A call and a put on the same underlying has the same

9   exercise price of 700. Current underlying price is at 720, the call costs RM 25 and the put costs

10   RM 5. The intrinsic value of the call is 20 (=720-700) and of the put is 0 (since the index is

11   above the put's exercise price). The time value of the call is 5 (=25-20) while that of the put is 5

12   (=5-0).

13

14   Implied Volatility

15

16   Implied volatility is the volatility percentage that explains the current market price of a financial

17   instrument. As the forces of supply and demand determine the market price of a financial

18   instrument, the volatility percentage must be adjusted to explain the market price of the financial

19   instrument. The implied volatility that produces the financial instrument's market price as the

20   theoretical value is the implied volatility.

21

22   3.   Overview of The Present Invention

23

24   The present invention involves a system, method, and computer program product for the

25   valuation (and thus, processing and trading) of real estate index linked financial instruments, and

26   / or financial instruments that are affected by real estate indices. In an embodiment of the

27   present invention, an organization which trades real estate index linked financial instruments

28   may provide a brokerage desk that facilitates trades of such instruments either for clients or for

29   its own proprietary account, as well as providing an interactive World Wide Web site accessible

30   via the global Internet for real estate predicted future indices and index information, pricing

31   models, and trade execution services. The organization may also provide information and data

1   sets that enable traders to identify and capitalize on market fluctuations affecting or driven by

2   real estate prices and index prices or values. The infrastructure supporting these operations may

3   be an organized electronic exchange, open outcry exchange, broker / dealer system, ECN

4   (electronic commerce network), or OTC process for real estate index linked financial

5   instruments. Such real estate index linked financial instruments may also be created as custom

6   products for particular entities, and may only be tradeable to another entity or entities which wish

7   to take delivery of such a custom real estate index linked financial instrument.

8

9   Such a system could also allow entities to intelligently trade and use real estate index linked

10   financial instruments not only to manage real estate-related market risks, but also to speculate for

11   profit. These entities may trade with each other in any multi-party combination or with internal

12   legal entities, and include but are not limited to:

13

14   1. Sovereign governments (e.g. United States)

15   2. Government agencies (e.g. Fannie Mae, Freddie Mac, Ginnie Mae)

16   3. Non-governmental organizations (e.g. International Monetary Fund, World Bank, Inter-
17   American Development Bank)

18   4. Pan-governmental organizations and treaty organizations (e.g. European Union, African
19   Union, Mercosur, NAFTA)

20   5. Territorial governments (e.g. Puerto Rico, U.S. or U.K. Virgin Islands, Macau,
21   Greenland)

22   6. Autonomous or semi-autonomous / privileged regions contained within a sovereign entity
23   (e.g. Hong Kong [of the People's Republic of China])

24   7. Provisional governments

25   8. Governments recognized by at least one other member of the United Nations (e.g.
26   Republic of China a.k.a. Taiwan [recognized only by Sao Tome], Turkish Cyprus
27   [recognized only by Turkey])

28   9. Commercial banks

29   10. Investment banks

30   11. Commercial / Investment banks (e.g. Citigroup)

31   12. Investment boutique firms

1   13. Private equity firms (e.g. Carlyle Group)

2   14. Commodity trading entities (including fuel and power, such as Dynegy, the former

3   Enron, and the former Mirant)

4   15. OTC trading entities

5   16. Insurance companies (e.g. Aetna)

6   17. Reinsurance companies (e.g. Munich Re)

7   18. Insurance / financial services hybrids (e.g. AIG, Citigroup [Travelers])

8   19. Mutual funds (e.g. Vanguard, Fidelity)

9   20. Venture capital funds (e.g. Kleiner Perkins Caufield Byers)

10   21. Hedge funds

11   22. Broker / dealer networks (e.g. Everen Securities)

12   23. Electronic brokers (e.g. E-trade)

13   24. Electronic commerce networks (e.g. Instinet or Archipelago)

14   25. Open outcry exchanges and their members (e.g. AMEX, a.k.a. American Stock

15   Exchange)

16   26. Real estate investment trusts (commonly known as REITs)

17   27. Retail investors of any level (such as individual / proprietor, partnership, limited liability

18   company, S corporation, and C corporation, either public or private.)

19

20   The present invention is designed to support a variety of business and regulatory requirements

21   for any of these parties transacting with each other in the trade of real estate index linked

22   financial instruments.

23

24   The present invention is described in terms of the above example. This is for convenience only

25   and is not intended to limit the application of the present invention. In fact, after reading the

26   following description, it will be apparent to one skilled in the relevant art how to implement the

27   following invention in alternative embodiments and without limitation for the benefit of anyone

28   whose "bottom line" can be affected by investing in real estate index linked financial

29   instruments.

30

31   II. System Architecture Overview

1

2 A. System Components

3

4 Referring to FIG. 1, a real estate index linked trading system 100, according to an embodiment

5 of the present invention, is shown. It should be understood that the particular trading system 100

6 in FIG. 1 is shown for illustrative purposes only and does not limit the invention. Other

7 implementations for performing the functions described herein will be apparent to persons

8 skilled in the relevant art(s) based on the teachings contained herein, and the invention is directed

9 to such other implementations. As will be apparent to one skilled in the relevant art(s), all of

10 components "inside" of the trading system 100 are connected and communicate via a

11 communication medium such as a local area network (LAN) 101.

12

13 The trading system 100 includes a trading server 102 that serves as the "back-end" (i.e., real

14 estate index processing system) of the present invention. Connected to the trading server 102 is

15 a financial database 104, a real estate index history database 108, and / or a real estate predicted

16 future index database 106. The trading server 102 is also connected to a Web server 110. As is

17 well-known in the relevant art(s), a Web server is a server process running at a Web site which

18 sends out web pages in response to Hypertext Transfer Protocol (HTTP) requests from remote

19 browsers. The Web server 110 serves as the "front end" of the present invention. That is, the

20 Web server 110 provides the graphical user interface (GUI) to users of the trading system 100 in

21 the form of Web pages. Such users may access the Web server 110 at the real estate index

22 trading organization's site via a plurality of internal workstations 110 (shown as workstations

23 110a-n).

24

25 A firewall 112 serves as the connection and separation between the LAN 101, which includes the

26 plurality of network elements (i.e., elements 102-110 and 120) "inside" of the LAN 101, and the

27 global Internet 103 "outside" of the LAN 101. Generally speaking, a firewall--which is well-

28 known in the relevant art(s)--is a dedicated gateway machine with special security precaution

29 software. It is typically used, for example, to service Internet 103 connections and dial-in lines,

30 and protects a cluster of more loosely-administered machines hidden behind it from an external

31 invasion.

1

2   The global Internet 103, outside of the LAN 101, includes a plurality of external workstations

3   114 (shown as workstations 114a-n). The external workstations 114 allow client-users (traders)

4   of the real estate index trading organization to remotely access and use the trading system 100.

5

6   The trading system 100 includes an administrative workstation 120 that may be used by the

7   trading organization to update, maintain, monitor, and log statistics related to the server 102 and

8   the trading system 100 in general. Furthermore, FIG. 1 depicts an information distribution

9   medium 116 connected to the Internet 103. This is to signify that information distribution

10   medium s 116 or other information distribution tools may access trading system 100 for the

11   purposes of, but not limited to, publishing the trading organization's real estate predicted future

12   indices for users, according to an embodiment of the present invention.

13

14   While one trading server computer 102 is shown in FIG. 1, it will be apparent to one skilled in

15   the relevant art(s) that trading system 100 may be run in a distributed fashion over a plurality of

16   the above-mentioned network elements connected via LAN 101. Similarly, while several

17   databases (i.e., 104, 106, and 108) are shown in FIG. 1, it will be apparent to one skilled in the

18   relevant art(s) that trading system 100 may utilize databases physically located on one or more

19   computers which may or may not be the same as sever 102. More detailed descriptions of the

20   trading system 100 components, as well as their functionality, are provided below.

21

22   1.   Real Estate Index History Database

23

24   An example real estate index history database 108 is shown in FIG. 2. The real estate index

25   history database 108 includes, for each time period in the view, one or more records for each

26   metropolitan area (MA). (The term MA closely resembles the well-known name Metropolitan

27   Statistical Area (MSA). However MA encompasses a larger surrounding geographical area /

28   region than the strict MSA definition. However, since MA and MSA are similar, they are used

29   interchangeably herein, and the use of either MA or MSA should not preclude understanding of

30   the other term for the purposes of understanding the present invention). The real estate index

31   history database 108 contains but is not limited to data on metropolitan areas, and could include

1 but is not limited to localities, cities, regions, states, nations, or multinational / international

2 areas. These records contain information specifying the real estate index information that

3 occurred in the subject MA in the time span represented in the view. Specifically, for each MA,

4 there is a record for each of several real estate index data types.

5

6 In an embodiment of the present invention, the real estate index history database 108 contains all

7 past historical real estate index data including the most recently published or "present" value.

8 There are different classes of real estate index data types in the real estate index history database

9 108. Classes of index values may be defined by a variety of time periods and with different

10 methods of summarizing information. The classes may include, but are not limited to, quarterly

11 index values, quarterly growth rates, annualized quarterly rates, moving quarterly averages,

12 annual index values, annual growth rates, moving annual averages, five-year index values, five-

13 year growth rates, five-year annualized growth rates, and moving five-year averages. As will be

14 apparent to one skilled in the art(s), other time periods and summarization techniques may be

15 used to present information on real estate indices within real estate index history database 108.

16

17 The "tick" columns in Fig. 2 simply denote whether a change in a real estate index value is an

18 uptick or downtick. An uptick or increase in the value of the index sets the tick value to 1, while

19 a downtick or decrease in the value of the index sets the tick value to -1. If there is no change in

20 value, the tick value equals 0. Of course, values other than 1, 0, and -1 could be alternatively

21 used to indicate these relationships. Also, other real estate index data types may be used, and the

22 processing of tick values may be applied across both the real estate index history database 108

23 and the real estate predicted future index database 106. Each recorded tick (either uptick or

24 downtick) in the price of a security is written to the real estate index history database, for the

25 purpose of keeping track of the number and value of consecutive incremental price movements

26 (both upwards and downwards) for the real estate index-linked financial instrument in question.

27 The real estate index history database is updated after each trade by performing a write SQL

28 statement which adds the abovementioned information.

29

30 The historical real estate index information in the real estate index history database 108 is

31 provided on a per period basis. As indicated above, the period may be any increment of time,

1   such as intraday, daily, weekly, bi-weekly, monthly, bimonthly, quarterly, semi-annually,

2   annually, etc. Preferably, the increment of time represented by a period is the same in both of

3   the real estate index databases (106 and 108) within trading system 100.

4

5   Each real estate index includes one or more data components. For example, the MSA for

6   Atlanta, GA includes quarterly growth rates, annualized quarterly growth rates, five-year

7   cumulative growth rates, and other elements. For any given period, the values of these data

8   components comprising the real estate indices are represented by the entries in the real estate

9   index history database 108 and are linked to the appropriate category data type. For example, in

10   the first quarter of 2002, the quarterly growth rate for the Atlanta MSA was 1.26% to an index

11   value of 188.5, from a previous MSA index value of 186.15 in the fourth quarter of 2001 (see

12   records 202 and 204 in FIG. 2 for a general representation). This real estate index value may be

13   replicated in a reference file where it is stored in an abbreviated format called P_1R_1, with P_1

14   representing the period of time and R_1 representing the particular real estate index to be

15   referenced. . This file is used as the "look up" to allow the system to determine which

16   instrument values will change in response to the change in the underlying real estate index (in

17   this example, the Atlanta MSA value).

18

19   2.   Real Estate Predicted Future Index Database

20

21   An example real estate predicted future index database 106 is shown in FIG. 3. The real estate

22   predicted future index database 106 includes, for each future time period in the view, one or

23   more records for each MA. These records contain information specifying the real estate index

24   value that is predicted to occur in the subject MA in the future time span represented in the view.

25   Specifically, for each MA, there is a record for each of several real estate index data types.

26

27   The real estate index predicted future database also contains several classes of real estate index

28   data types, as in the real estate index history database 108, which are for a variety of predicted

29   future real estate index values. These categories are the same as those described above with

30   respect to the real estate index history database 108. Accordingly, the description above of the

31   real estate index history database 108 also applies to the real estate index predicted future

1   database 106.

2

3   3.   Relationship Between Past and Future Databases

4

5   As evident by the description above, the real estate index history database 108 is a past database

6   because it contains history information. In contrast, the real estate predicted future index

7   database 106 is a future database because it contains information pertaining to predicted real

8   estate index movement in the future. Both databases contain information on a per period basis.

9   Preferably, the increment of time represented by a period is the same in both databases. Also,

10   the periods in both databases are synchronized in order to aid the transfer of information between

11   the two databases.

12

13   4.   Time Periods

14

15   As discussed above, data may be stored in the real estate index history database 108 using any

16   time increment or period, including but not limited to daily, weekly, monthly, quarterly, etc.

17   Similarly, real estate predicted future index information for each location may be stored in the

18   real estate predicted future index database 106 on a daily basis, a weekly basis, a monthly basis,

19   or a quarterly basis. Preferably, the time increment / period is the same in both databases 108

20   and 106. In practice, a system administrator will select the time increment(s) / period(s) during

21   an administrator setup process using administration workstation 120 in order to meet the

22   demands of traders using the plurality of workstations 110 and 114.

23

24   5.   Financial Database

25

26   The financial database 104 of trading system 100 contains current financial data that is used by

27   the trading server 102. The financial database 104 includes information relevant to calculating

28   an investment's risk-free rate of return. Such information, as will be apparent to one skilled in

29   the relevant art(s), may include but is not limited to one or more of the Discount Rate, the Prime

30   Interest Rate, the 90-day Treasury Bill, the London Interbank Offered Rate (LIBOR), the

31   Eurodollar Rate, and the like. As will be explained below with reference to FIG. 4, the risk-free

1   rate information within the financial database 104 is necessary for determining the cost-of-cash

2   during the operation of the trading system 100. The financial database 104 may include

3   additional financial information on an application specific basis.

4

5   6.   Information Retrieval and Dissemination from Databases

6

7   The user may choose any number of the above categories of information for display or download

8   for the information in the real estate index history database 108, real estate predicted future

9   database 106, and financial database 104, by an on-screen selection or check list. After the

10 categories of information have been chosen, the user may execute the research via a selection

11 option on the keyboard or via mouse and graphical user interface (GUI). The system then

12 compiles and executes a selection of SQL query calls according to all selections made by the

13 user. The query results are compiled and prepared for display. Once the results are compiled,

14 pre-programmed graph, trend line and textual templates are used to display the query results on

15 the GUI client display for all chosen securities and information categories described above.

16 After display, the user is given the option to download the displayed results and underlying query

17 data. The user is allowed to select from a variety of download formats, such as ASCII, xbase,

18 dbf, HTML, XML, FPML, MDDL, tif, gif, bmp, or the like. The user is allowed to choose a

19 download location on the local client. The system then proceeds to compile the data into the

20 chosen format. The data is then transferred, using any one of a variety of protocols such as

21 zmodem, xmodem, ftp, TCP / IP, or any one of the OS industry standard protocols.

22

23 7.   Data Feeds and Data Distribution

24

25 In a preferred embodiment of the present invention, the real estate index history database 108

26 and the real estate predicted future index database 106 can provide information for the purpose

27 of distributing information in information distribution medium 116 or for resale as a data feed to

28 a data vendor (including, but not limited to, Bloomberg, Fitch, Moody's, Reuters, Standard &

29 Poor's, Dun and Bradstreet, any physical or electronic exchange, any Small Order Execution

30 Service (SOES) or electronic commerce network (ECN) or broker / dealer network, and / or

1   other commercial services). The data to be distributed could include, but is not limited to, the

2   following:

3

4   1.   Real estate index historical value per MA per time period

5   2.   Real estate predicted future index value per MA per time period

6   3.   List of real estate index linked financial instruments currently being traded, and / or

7   list of real estate index linked financial instruments that were previously traded but

8   are no longer listed.

9   4.   Number of contracts in circulation per real estate index linked financial instrument

10   ("open interest")

11 5.   Characteristics of each real estate index linked financial instrument (e.g. volatility,

12   price quoted in either fractional or decimal format, expiry date or alternatively time to

13   maturity, etc.)

14 6.   Metrics linked to the characteristics of real estate index linked financial instruments

15   (e.g. total annual return for the holder of the instrument, total annual portfolio return

16   for the holder of several types of real estate index linked financial instruments, etc.)

17 7.   Last trading price of each particular real estate index linked financial instrument

18 8.   Price movement of last trading price in relation to the previous price movement

19 9.   Price movement since the previous week, previous month, year to date, previous 52

20   weeks, or over other measurable periods of time, expressed either in discrete terms or

21   in percentage of change.

22 10.   Lists of indices with particular movement qualities, including, by way of example

23   only, "10 best performers" over a measurable time period, "10 worst performers"

24   over a measurable time period, and "10 most active" indices in terms of trading

25   volume of financial instruments of a specific class linked to the indices. As will be

26   apparent to one skilled in the relevant art(s), it is within the scope and spirit of the

27   present invention to allow a variety of combinations in presenting such statistics.

28 11.   Put-call ratio applicable to options on each particular real estate index.

29 12.   Long-short ratio applicable to financial instruments linked to each particular real

30   estate index.

31 13.   Number of total contracts of each type traded in a trading day ("volume").

64

1   14.   Currency value, in each applicable currency of denomination, of all trades of each

2   contract type traded in a trading day.

3   15.   Number of buy vs. sell trades executed in a trading day

4   16.   Number of contracts involved in buy trades in a trading day vs. number of contracts

5   involved in sell trades in a trading day.

6   17.   Total short interest in a particular type of real estate index linked financial instrument,

7   expressed either as the discrete volume of contracts sold short for a type of real estate

8   index linked financial instruments, and / or a percentage of the total number of

9   contracts outstanding of a real estate index linked financial instrument that have been

10   sold short.

11   18.   The prevailing stop limit order for each real estate index linked financial instrument,

12   as well as relevant volume figures for the instrument.

13   19.   External factors such as changes in a variety of published interest rates, published

14   inflation rates, and other published economic indicators which may impact real estate

15   index linked financial instruments. By way of example, an increase or decrease in

16   interest rates could trigger algorithmic calculations which affect terms and pricing for

17   many real estate index linked financial instruments and also currency values (e.g.

18   interest rates for money market account funds that have not yet been invested in a real

19   estate index-linked security) tracked within the system.

20

21 As will be apparent to one skilled in the relevant art(s), other calculations are possible based

22 upon this list and based upon the present invention in total. For example, by having the total

23 number of buy trades vs. sell trades executed in each trading day, it would be possible to sum up

24 and publish the total number of buy trades vs. sell trades executed in an entire month, or year. In

25 a further embodiment of the present invention, such information may be packaged within a front-

26 end interface GUI module with trade execution, account management, and research reporting

27 capabilities, for sale to and use by users such as individual or institutional traders, analysts,

28 portfolio managers, and others (already noted within these claims for the present invention) as

29 entities whose "bottom line" may be affected by investing in real estate index linked financial

30 instruments. Also, it is an embodiment of the present invention that such data feeds may be

31 either automated or managed manually. Finally, it is another embodiment of the present

1   invention that input streams to the real estate index history database 108 may be taken and sent
2   out again as part of the outbound data streams. Such input streams could include, but are not
3   limited to, data updates received directly from the systems of real estate index publishers such as
4   OFHEO, if such an index publisher has the system that provides data output that would be
5   recognized as data input by the present invention.
6
7   It is also a preferred embodiment of the present invention that such data streams may be adjusted
8   to define and output fundamental data relating to the value of a security on given dates with
9   search limitations relating to technical trading rules, holidays, and historical events, business
10 events, government reports, trigger dates (for financial guarantees, by way of example), and even
11 particular days of the week, weeks, months, or years. For example, in the preferred embodiment
12 of the present invention, a user can request a bar chart of U.S. Conventional Mortgage Home
13 Price Indices on all days when the report was released by the U.S. Government, or the data
14 affecting all related and affected interest rates after a prime rate increase. Such a search could be
15 further limited to stipulate that only those occurrences between Memorial Day and Labor Day
16 when the prime rate was over 3% should be output. In addition, in conjunction with real estate
17 index information and real estate index linked financial instrument information, the database
18 may output commonly-available market averages information, such as the Dow Jones averages
19 each day over extended periods, or commonly-available economic indicators information such as
20 the consumer price index, global GNP or GDP figures, real estate sales data, revenues and profits
21 for REITs (for example), and other such indicators, together with the dates upon which this
22 information is released if appropriate, such as, but not limited to: major holidays, government
23 holidays, international holidays and / or foreign holidays, special holidays, triple-witching days,
24 contract expiration days, bear or bull market days, expiry / renewal days for financial guarantees
25 such as letters of credit, and the like. The days and holidays may be denoted for the purpose of
26 system alerts to users. Real estate index linked financial instruments will already carry a
27 maturity date or date of expiration within their definition, so that they will become expired upon
28 either exercise prior to the maturity date of the instrument, or will become expired if the maturity
29 date passes without any exercise action on the part of the holder of the financial instrument.
30

1 III. The Black-Scholes Pricing Model

2

3 Before detailing the operation of the present invention, it is important to detail the specifics of

4 the Black-Scholes pricing model. It is noted that, for illustrative purposes only, the invention is

5 described with reference to the Black-Scholes pricing model. However, the invention is not

6 limited to this embodiment. Instead, embodiments of the invention utilize variations of the

7 Black-Scholes pricing model discussed herein. Also, other embodiments of the invention utilize

8 pricing models other than the Black-Scholes model, such as binomial models, trinomial models,

9 Monte Carlo simulations, closed form solutions and neural networks. The following description

10 applies to such other embodiments of the invention. The Black-Scholes formula for determining

11 the price of a call option, C, using the five parameters essential to the pricing of an option: (1)

12 the strike price K; (2) the time to expiration t, (3) the underlying commodity price S; (4) the

13 volatility of the commodity σ ("sigma"); and (5) the prevailing interest rate r, is shown in

14 equation (2):

15

16 $C = S*N(d_1) - Ke^{-(rt)} *N(d_2)$ (2)

17

18 As will be apparent to one skilled in the relevant art(s), e is the exponential function--the inverse

19 of the natural logarithm ln--that is equal to, up to four significant decimal places, 2.7183. The

20 variables d_1 and d_2 within equation (2) are expressed as shown in equations (3A) and (3B),

21 respectively:

22

23 $d_1 = [\ln(S/K) + (r + \sigma^2/2)^t] / \sigma\sqrt{t}$ (3A)

24

25 $d_2 = d1 - \sigma\sqrt{t}$ (3B)

26

27 The function "N( )" is the standard normal distribution function, which, as is well known in the

28 relevant art(s), may be accurately approximated for any value z using equation (4):

29

30 $N(z) = 1 - (1 / (\sqrt{2} * \pi) * e^{-z2/2} * (b1 * k + b2 * k^2 + b3 *k^3)$ (4)

31

1   Further, the variable k used in equation (4) is defined as shown in equation (5):

2

3    $k=1/(1+a*z)$ (5)

4

5   The values a, b1, b2, b3 are constants equal to {a=0.33267; b1=0.4361836; b2=-0.1201676; and

6   b3=0.937298}.

7

8   Having presented the Black-Scholes formula for a call option, equation (6) describes the

9   expression for the price P of a put option:

10

11   $P=C-S+Ke^{-(rt)}$ (6)

12

13   Having presented the Black-Scholes pricing model, the operation of the present invention and its

14   application to pricing real estate index linked financial instruments may now be explained.

15   However, as indicated above, while the present invention is described in terms of adopting the

16   Black-Scholes model to apply to real estate index linked financial instruments, it will be apparent

17   to one skilled in the relevant art(s), that other pricing models may be so adopted. Examples of

18   these alternative pricing models have already been discussed, including but not limited to

19   binomial models, trinomial models, Monte Carlo simulations, and other models including but not

20   limited to closed form solutions and neural networks.

21

22   IV. General System Operation

23

24   Referring to FIG. 4, a flowchart 400 representing the operation of trading system 100, according

25   to an embodiment of the present invention, is shown. Flowchart 400 begins at step 402 with

26   control passing immediately to step 404.

27

28   A. Inputs

29

30   In steps 404 and 406, the start date and the maturity date, respectively, of the contract are entered

31   into the real estate index trader server 102 of trading system 100. In step 408, the geographic

1   location (or region) which serves as the subject of the contract is entered. The geographic

2   location can be a single location or multiple locations. That is, the geographic location may be a

3   single MSA or a collection (i.e., "basket") which includes a plurality of different MSAs each of

4   which could have different weightings in the basket. In step 409, the currency denomination

5   which serves as the basis of the contract is entered (in some embodiments, multiple currency

6   terms can be entered in any number of inter-relationships). Then, in step 410, the cost of cash is

7   entered. The cost of cash (i.e., the risk-free rate) information may be read from the financial

8   database 104 of the trading system 100, or may be obtained from another source, including, but

9   not limited to, an on-line financial service. The above information may be entered by a user by

10   using a graphical user interface screen, for example.

11

12   In an embodiment of the present invention, the user of system 100 may enter the time period

13   (steps 404 and 406), the geographic location (step 408), and the currency(s) of denomination

14   (step 409), and the real estate index history and real estate predicted future index information, as

15   well as financial information, will automatically be retrieved from the appropriate databases (see

16   FIG. 1) to populate the GUI screen.

17

18   B. Processing and Output

19

20   In step 412, the real estate index history database 108 is read so that the trading server 102 has

21   the correct information for processing. The information read from the real estate index history

22   database 108 includes the past real estate index information for one or more fixed past time

23   periods for the geographic location(s) entered in step 408. Alternatively, the trading server 102

24   could query and obtain the real estate index information from some other source, such as a

25   commercial service. As mentioned above, real estate index history database 108 contains the

26   data necessary to provide the trading server 102 the particular real estate index information,

27   including currency denomination and related regulatory terms, which serve as the basis for the

28   contract.

29

30   In step 414, the real estate predicted future index 106 is read so that the trading server 102 has

31   the correct information for processing. That is, the trading server 102 would query the real estate

1   predicted future index database 106 (or obtain the information from some other source, such as a

2   commercial service) for the period represented by the start and maturity dates entered in steps

3   404 and 406, respectively. As mentioned above, real estate predicted future index database 106,

4   similar to real estate index history database 108, contains the data necessary to provide the

5   trading server 102 with the particular real estate information (including currency denomination)

6   which serves as the basis for the contract as entered in step 409. During step 414, the real estate

7   index server 102 may identify the real estate predicted future index movement pattern that occurs

8   in the future time period specified by steps 404 and 406. Consider, for example, real estate

9   predicted future index database 106 shown in FIG. 3. As indicated by records 302 and 304, the

10   real estate predicted future index movement pattern in the Atlanta, GA MSA in future period T_1

11   may be replicated in a reference file where it is stored in an abbreviated format called T_1R_1, with

12   T_1 representing the period of time and R_1 representing the particular real estate index to be

13   referenced. This file is used as the "look up" to allow the system to determine which instrument

14   values will change in response to the change in the predicted future value of the underlying real

15   estate index (in this example, the Atlanta MSA value).

16

17   After the completion of steps 402 to 414, the trading server 102 of trading system 100 may now

18   calculate the price of a real estate index linked financial instrument (e.g. real estate index linked

19   call option). Normally four parameters of equation (2), K, S, r, and t, can be figured with

20   particularity. However, the volatility of a commodity (e.g., a stock or any other underlying asset,

21   security or index), σ (sigma), cannot. With this parameter, human judgment comes into play to

22   quantify. There are traditionally two methods for measuring volatility--historical and implied.

23   This is where future movement of real estate indices must be considered.

24

25   As mentioned above, most models assume that, for example, last year's real estate cycles (and

26   therefore the effect of those cycles upon the indices discussed heretofore in this document) will

27   repeat from year to year. Historical analysis has shown, however, that this assumption does not

28   always hold true. Thus, the present invention can make use of real estate predicted future index

29   database 106 (in conjunction with real estate index history database 108) to arrive at a more

30   accurate volatility calculation, and thus a better option price.

31

1   In step 416, a pricing model (e.g., the Black-Scholes pricing model of equation (2), or some

2   other well-known pricing model) which has been modified to take into account both past and real

3   estate predicted future index changes, is applied. The present invention contemplates four real

4   estate index-related modifications to the Black-Scholes pricing model of equation (2) (such

5   modifications can also be applied to other pricing models). First, the strike price, K, is the

6   forecasted (i.e., predicted future) real estate index condition.

7

8   Second, because we are dealing with real estate indices and not an underlying stock with a

9   quoted (i.e., market) price, the underlying commodity price, S, is the historical real estate index

10   value for the geographic region for the time period between the start and maturity dates.

11

12   Third, the volatility σ, using the historical method, is the annualized standard deviation of the

13   natural logarithm (ln) of the real estate index as called for in the contract. In a preferred

14   embodiment of the present invention where the real estate index history database 108 includes

15   data for twenty years, the volatility will be an annualized standard deviation of the measure of

16   the real estate index over the past twenty years.

17

18   Fourth, as a consequence of the modifications mentioned above, the standard normal distribution

19   function calculation of equations (4) and (5) is also modified. To account for real estate indices,

20    $N(d_1)$ is first calculated and then $N(d_2)$ is set to the same value. This is done because many

21   pricing models, including the Black-Scholes pricing model, are designed for commodities that

22   fluctuate in price on a given day. That price may vary from minute to minute during active

23   trading on an exchange (e.g., NYSE) and would be important in the valuation of an option for

24   that commodity. However, because the present invention deals with real estate indices as the

25   underlying commodity, the selected real estate index conditions fluctuations for a given day are

26   not as relevant considering real estate index linked or real estate index-impacted financial

27   instruments deal with average real estate index movements.

28

29   In equations (7) and (8) below, the sum n+1 represents the number of historical real estate index

30   observations calculated from querying the real estate index history database 108. Thus, u_i is

31   defined as the logarithm of the price S relative between two real estate index "prices" (i.e.,

1   historical real estate index measurements) S_i and S_{i-1} and is expressed by equation (7):

2

3     $u_i = \ln (s_i \, / \, s_{i+1})$ (7)

4

5   Thus, historical volatility, σ, can be calculated using equation (8):

6

7   n

8     $\sigma^2 = \sum (u_i - u)^2$ (8)

9   i=1

10

11   In equation (8), u is the mean of all real estate index observations. Finally, σ may then be

12   computed by taking the square root of σ^2.

13

14   In step 418, trading system 100 may now output the "predicted future price of real estate index

15   financial instruments" (i.e., C for a call-type real estate index linked option) for the real estate

16   index linked financial transaction. That is, trading system 100 may publish a call option contract

17   price for a particular period (i.e., between the start date and maturity date), for a particular

18   geographic location (e.g., MSA), for a particular real estate index. The operation of trading

19   system 100 is thus complete as indicated by step 420 of flowchart 400.

20

21   In an alternative embodiment, as will be apparent to one skilled in the relevant art(s) based on the

22   teachings contained herein, trading server 102 of trading system 100 may operate in a manner

23   where the volatility σ is outputted when given the cost of a real estate index linked financial

24   instrument contract C. Furthermore, the present invention contemplates an embodiment where

25   standard inputs are entered into trading system 100 for given geographic location so that the

26   relevant "Real Estate Index" value, in quote form or not in quote form, may be published in the

27   information distribution medium 116. That is, a "Real Estate Index" value may be published in a

28   information distribution medium 116 or other information distribution tools for a plurality of

29   MSAs given an agreed upon set of inputs for a real estate index linked financial instrument or

30   instruments. For example, the output of step 418 may be a "Real Estate Index Summary"

31   (similar to the Dow^{TM} Industrials or S&P^{TM} 500) for future months for a particular MSA.

1

2 V. Detailed Example of System Operation

3

4 In an embodiment of the present invention, trading server 102 will provide a GUI (as shown in

5 FIG. 5) for users, such as the in-house traders using the plurality of workstations 110, to enter

6 inputs and receive the outputs as described in flowchart 400. Further, trading server 102 in

7 conjunction with the web server 110 will also provide a GUI to the plurality of external users on

8 the workstations 114 to enter inputs and receive the outputs as described in flowchart 400.

9

10 Still referring to FIG. 5, a detailed example of the operation of trading system 100 is presented in

11 Table 2 below. Table 2 illustrates example numbers for each step of flowchart 400 presented in

12 FIG. 4. In this example, as will be apparent to one skilled in the relevant art(s) based on the

13 teachings contained herein, trading server 102 will use the real estate index data stored in

14 databases 106 and 108 in calculating the relevant changes to real estate index linked financial

15 instruments for steps 412 and 414, respectively.

16

17 A GUI screen 500 with the representative numbers in Table 2 is shown in FIG. 5. The GUI

18 screen 500 includes a pull-down menu 502 listing each MSA for which the real estate index

19 history database 108 and real estate predicted future index database 106 have available data and

20 thus, trading system 100 may process a financial transaction for.

21

22 TABLE 2

23	Step	Input(s) / Calculation(s)	Equation(s)
24			
25	404	Start Date = 11/1/98	
26	406	Maturity Date = 11/30/98	
27	408	Metro Area = Washington, D.C.	
28	409	Currency = USD	
29	410	Interest Rate = 3%	
30	412	Latest Index Value = 456	(2)
31	414	Strike Price = 366	(2)

73

1	416	S = 456	(2)
2		K = 366	(2)
3		t = 29 days = 29/30 months = 0.9667	
4		r = 3%	
5		e = 2.71828	
6		$\sigma = 83$	(7) & (8)
7		$d_1 = [\ln(S/K) + (r + \sigma^2/2)^t] / \sigma\sqrt{t}$	(3A)
8		$d_1 = 32.18$	
9		$d_2 = d_1 - \sigma\sqrt{t} = -49.43$	(3B)
10		$N(d_1) = 14\%$	(4) & (5)
11		$N(d_2) = 14\%$	
12	418	$C = S*N(d_1) - Ke^{-(rt)} *N(d_2) = \$4,486$	(2)

14 The GUI screen 500 further includes a display 504 indicating the latest index value and strike

15 price for the geographic location highlighted in the pull down menu 502. The real estate index

16 information shown in display 504 is calculated from the real estate index history database 108

17 and real estate predicted future index database 106, respectively, after the user has used input

18 boxes 506 to enter the contact start and maturity dates, respectively. GUI Screen 500 also

19 includes calculation boxes 508 which show the various components of equation (3A) and

20 equation (3B). Upon trading system 100 calculating equation (3A) and equation (3B), the call

21 option price is displayed in a box 510 within the GUI screen 500.

23 VI. Environment

25 The present invention (i.e., trading system 100 or any part thereof) may be implemented using

26 hardware, software or a combination thereof and may be implemented in one or more computer

27 systems or other processing systems. In fact, in one embodiment, the invention is directed

28 toward one or more computer systems capable of carrying out the functionality described herein.

29 An example of a computer system 600 is shown in FIG. 6. The computer system 600 includes

30 one or more processors, such as processor 603. The processor 603 is connected to a

31 communication bus 602. Various software embodiments are described in terms of this

1   exemplary computer system. After reading this description, it will be apparent to a person

2   skilled in the relevant art how to implement the invention using other computer systems and/or

3   computer architectures.

4

5   Computer system 600 also includes a main memory 605, preferably random access memory

6   (RAM), and may also include a secondary memory 610. The secondary memory 610 may

7   include, for example, a hard disk drive 612 and/or a removable storage drive 614, representing a

8   floppy disk drive, a magnetic tape drive, an optical disk drive, etc. The removable storage drive

9   614 reads from and/or writes to a removable storage unit 618 in a well known manner.

10   Removable storage unit 618, represents a floppy disk, magnetic tape, optical disk, etc. which is

11   read by and written to by removable storage drive 614. As will be appreciated, the removable

12   storage unit 618 includes a computer usable storage medium having stored therein computer

13   software and/or data.

14

15   In alternative embodiments, secondary memory 610 may include other similar means for

16   allowing computer programs or other instructions to be loaded into computer system 600. Such

17   means may include, for example, a removable storage unit 622 and an interface 620. Examples

18   of such may include a program cartridge and cartridge interface (such as that found in video

19   game devices), a removable memory chip (such as an EPROM, or PROM) and associated socket,

20   and other removable storage units 622 and interfaces 620 which allow software and data to be

21   transferred from the removable storage unit 622 to computer system 600.

22

23   Computer system 600 may also include a communications interface 624. Communications

24   interface 624 allows software and data to be transferred between computer system 600 and

25   external devices. Examples of communications interface 624 may include a modem, a network

26   interface (such as an Ethernet card), a communications port, a PCMCIA slot and card, etc.

27   Software and data transferred via communications interface 624 are in the form of signals 628

28   which may be electronic, electromagnetic, optical or other signals capable of being received by

29   communications interface 624. These signals 628 are provided to communications interface 624

30   via a communications path (i.e., channel) 626. This channel 626 carries signals 628 and may be

31   implemented using wire or cable, fiber optics, a phone line, a cellular phone link, an RF link and

1   other communications channels.

2

3   In this document, the term "computer program product" refers to removable storage units 618,

4   622, and signals 628. These computer program products are means for providing software to

5   computer system 600. The invention is directed to such computer program products.

6

7   Computer programs (also called computer control logic) are stored in main memory 605, and / or

8   secondary memory 610 and / or in computer program products. Computer programs may also be

9   received via communications interface 624. Such computer programs, when executed, enable

10   the computer system 600 to perform the features of the present invention as discussed herein. In

11   particular, the computer programs, when executed, enable the processor 603 to perform the

12   features of the present invention. Accordingly, such computer programs represent controllers of

13   the computer system 600.

14

15   In an embodiment where the invention is implemented using software, the software may be

16   stored in a computer program product and loaded into computer system 600 using at least one

17   removable storage drive 614, hard drive 612 or communications interface 624. The control logic

18   (software), when executed by the processor 603, causes the processor 603 to perform the

19   functions of the invention as described herein.

20

21   In another embodiment, the invention is implemented primarily in hardware using, for example,

22   hardware components such as application specific integrated circuits (ASICs). Implementation

23   of the hardware state machine so as to perform the functions described herein will be apparent to

24   persons skilled in the relevant art(s).

25

26   In yet another embodiment, the invention is implemented using a combination of both hardware

27   and software.

28

29   While preferred embodiments of the invention have been described and illustrated, it should be

30   apparent that many modifications to the embodiments and implementations of the invention can

31   be made without departing from the spirit or scope of the invention. For example, while only

76

1   vanilla American options are explained in detail in the interest of simplicity, the same general

2   approach can be applied to computing volatilities implied by exotic American options and / or

3   American options with transaction costs and / or other varieties of options, as well as the inverse

4   pricing of other financial instruments not described herein, such as, but not limited to, futures,

5   forwards, swaps, swaptions, caps, floors, collars, corridors, notes, etc. The modules illustrated in

6   FIG. 1 as making up trading system 100 may be one or more hardware, software, or hybrid

7   components residing in (or distributed among) one or more local or remote computer systems.

8   Although the modules are shown as physically separated components, it should be readily

9   apparent that the modules may be combined or further separated into a variety of different

10   components, sharing different resources (including processing units, memory, clock devices,

11   software routines, etc.) as required for the particular implementation of the embodiment. Indeed,

12   even a single general purpose computer executing a computer program to produce the

13   functionality described herein may be utilized to implement the illustrated embodiments. A user

14   interface device may be implemented to input and / or output information during an exchange of

15   information between user and trading system 100. The user interface device may be

16   implemented as a graphical user interface (GUI) containing a display or the like, or may be a link

17   to other user input / output devices known in the art. The depiction of external users 114a to

18   114n is made to represent a variety of known users and the supporting systems that provide user

19   access, such as networks and connected systems, i.e. local or wide area networks, a company

20   intranet, systems providing Internet access, electronic communications network (ECNs), small

21   order exchange systems (SOES), on-line brokers or other trading networks, or other such

22   communications tools.

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24   VII. Conclusion

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26   While various embodiments of the present invention have been described above, it should be

27   understood that they have been presented by way of example, and not limitation. It will be

28   apparent to persons skilled in the relevant art that various changes in form and detail may be

29   made therein without departing from the spirit and scope of the invention. This is especially true

30   in light of technology and terms within the relevant art(s) that may be later developed. Thus, the

1 present invention should not be limited by any of the above-described exemplary embodiments,

2 but should be defined only in accordance with the following claims and their equivalents.

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